The Mouth of the Ausable River

DEPARTMENT OF PLANNING AND DEVELOPMENT

The Honourable Wm. Griesinger, Minister

A. H. Richardson, Chief Conservation Engineer

AUSABLE VALLEY

CONSERVATION REPORT

ONTARIO

TORONTO
1949

LETTER OF TRANSMITTAL

Honourable William Griesinger, Minister,
Department of Planning and Development,
Parliament Buildings,
Toronto, Ontario.

Honourable Sir:

I take pleasure in transmitting herewith a Conservation Report on the Ausable Valley, in six sections namely:

General (Location and Boundaries, Geology, Physiography and Land Settlement); Soils and Land Use; Forestry; Water; Wildlife and Recreation.

Yours very truly,

A.H. Richardson,
Chief Conservation Engineer.

Toronto, July 21, 1949.

One hundred copies of the first edition of this Report have been issued, of which this is

Number 46

E R R A T A

PART V - WILDLIFE

1. Page 2, line 23: For "Myrtle Warbler" read "Least Flycatcher".

2. Page 36: Substitute the following for the deleted section:

   "The marshes are trapped in season by the owner. Illegal trapping by other trappers is reported to be common."

DEPARTMENT OF PLANNING AND DEVELOPMENT

CONSERVATION BRANCH

A.H. RICHARDSON, M.A., S.M.Silv., F.E., P.Eng.,
Chief Conservation Engineer

A.S.L. BARNES, B.Sc.F.,
Forestry

C.E. BUSH, B.A.Sc., O.L.S., P.Eng.,
Hydraulic Engineering

W.J.P. CRESWICK, B.A.,
Soils

K.M. MAYALL, M.A., B.Sc.F.,
Wildlife and Recreation

H.F. CROWN, B.S.A.,
Extension

L.N. JOHNSON, B.S.A.,
Conservationist

V.B. BLAKE,
Historical Research

GLORIA NEWSON, B.A.,
Editorial

PROFESSOR G. ROSS LORD, B.A.Sc., S.M., Ph.D.,
University of Toronto
Consultant in Hydraulic Engineering

PROFESSOR F.P. IDE, M.A., Ph.D.,
University of Toronto
Consultant in Fish Research

ACKNOWLEDGEMENTS

While the Ausable Valley Report has been prepared by the staff of the Conservation Branch of the Department of Planning and Development, University staffs and members of other organizations have contributed generously to the supplying of data.

We wish specially to thank Professor D.F. Putnam of the University of Toronto and Mr. L.J. Chapman of the Ontario Research Foundation for use of maps of physiography, also Professor F.F. Morwick of the Ontario Agricultural College for assistance in appraising capabilities of soils. Growers and shippers in the Thedford area, especially Mr. W. Blewett, are sincerely thanked for information they so kindly gave regarding land use on the Thedford Swamp.

We gratefully thank Mr. L.L. Snyder, Curator of Ornithology, Mr. James L. Baillie, Ornithologist, and Stuart L. Downing, Mammalogist, all of the Royal Ontario Museum of Zoology, Toronto, for their assistance in the preparation and checking of bird and mammal lists.

For their kindness in allowing us to use their files, special thanks are due to the Editor and staff of the Exeter Times-Advocate; the Editor and staff of the Parkhill Gazette, particularly Miss Mary Dawson; the Editor and staff of the Forest Standard; and to the Dominion Bureau of Archives, Ottawa. Their assistance was most helpful in preparing the historical section of this report.

We wish also specially to thank the firm of Messrs. McCubbin and Brisco, Surveyors and Civil Engineers, for their generosity in making available to us plans and profiles of surveys made by them in the past and also Major J.C. Dawson for observations he made for us of flood conditions.

RECOMMENDATIONS

RECOMMENDATIONS

STATED OR IMPLIED IN THIS REPORT

Soils and Land Use

1. That contour tillage, strip-cropping, grassed waterways and restricted rotations be established on land designated as suitable for conservation farming on the Map of Recommended Land Use, and that demonstrations be arranged in these areas to promote practices of conservation farming. P.71-74.

2. That farm woodlots be fenced from cattle and that plantations be established wherever feasible on steeply sloping land and gravelly soils designated as plantable. P.78, 79.

3. That permanent sod be established with pasture improvement on land designated for this purpose and that pastures be managed according to sound principles, including mowing to reduce weeds. P.76-78.

4. That intertilled crops, which expose soil to erosion, be restricted on land which is sloping, but not suitable for contour tillage. P.74.

5. That long rotations of sod and grain be established on clay and silty soils of the uplands to resist erosion and to build up organic content and fertility of the soil. P.75.

6. That ponds and streams used for watering stock be protected from trampling and pollution by cattle. P.81.

7. That the River Authority stimulate and guide all individuals and agencies concerned in the watershed to formulate and carry out a policy of adjusting Land Use to Land Capability. P.84.

8. That further research and investigation be made (1) in comparing Land Use to Soil Type and Erosion; (2) management of pastures and long rotations; and (3) methods of

increasing organic content of soils by green manure crops, field composting and more efficient use of stable manure and plant waste. P.82.

9. That the River Authority support a programme of education and publicity to acquaint the public, especially youth, with Land Use Problems and the methods of remedying abuses of natural resources. P.83.

10. That a gully control demonstration be carried out on the north half of Lot 9, Concession X, Township of Williams East. P.88.

Forestry

1. That the Ausable Forest of about 37,513 acres, comprising 13 areas of marginal and sub-marginal land, be established by the Authority to protect the natural water storage areas of the watershed and form the basis of a sound forestry policy for the watershed. P.39.
2. That a fire protective system be established under the Authority which will regulate the burning of slash and peat on private land and that a fire protective system be set up to fight fire anywhere in the watershed, but particularly in the "Pinery". P.28.
3. That the Authority expropriate all tax delinquent land subject to the regulations of the Municipal Act. P.60.
4. That natural regeneration be encouraged wherever possible and that open areas be planted where necessary. P.47.
5. That reforestation of privately-owned land be encouraged in every way possible, particularly on blow sand, glacial beaches and poorly-drained land. P.30.
6. That counties and townships be encouraged to establish and extend the forests within their boundaries. P.36.
7. That schools within the watershed be encouraged to enter the Provincial School Forestry Competition. P.38.
8. That the Authority inaugurate a scheme to aid farmers in

fencing their woodlots similar to that adopted by the County of Halton. P.51.

Water

1. That for flood control on the Ausable River the following works be carried out:-

    MAIN AUSABLE SYSTEM:

    The Lesser Port Franks Improvement Channel
    (Scheme A.1 (a) - $109,000.00)
    (With Breakwaters - $276,396.00).

    PARKHILL CREEK SYSTEM:

    The Lesser Old River Bed Improvement
    (Scheme B.1 (a) - $276,501.00).

    If a greater degree of protection is desired such as against spring floods of the 1947 magnitude, it is recommended that the following works be carried out on the two systems:-

    MAIN AUSABLE SYSTEM:

    The Lesser Port Franks Improvement Channel
    and the Arkona Dam (60 feet) and Reservoir
    (Scheme A.2 (b) - $999,454.00).

    PARKHILL CREEK SYSTEM:

    The McInnis Dam (31 feet) and Parkhill Dam
    (29 feet) combined with the Lesser Old River
    Bed Improvement
    (Scheme B.2 (b) - $884,268.00). P.51.

2. That for summer flow a dam be constructed at Hay Swamp at an estimated cost of $200,000.00. P.53.

3. That a number of small dams listed in Table H-4 following Page 52 should be planned for the future in order to increase summer flow and for deep seepage for the watershed.

Wildlife

1. That farmers be encouraged to improve land for wildlife by the elimination of grazing of woodlots, by selective rather than clear cutting, by planting small groups of trees and field boundary hedges and by planting wildlife food patches. P.16.

2. That the streams of the watershed be improved for muskrats

and fish by any means capable of inducing permanent summer flow and by planting the stream banks with alders and willows. P.42, 43.

3. That consideration be given to a plan for decentralized control over the setting of muskrat trapping dates to overcome the effects of differences in climate in different seasons. P.23.
4. That the season on muskrats be closed for one year. P.23.
5. That where the Authority requires extensive source areas, the right to trap for several years in succession be leased to individual trappers. P.23.
6. That consideration be given to the protection of predators of the meadow mouse near reforested areas, particularly those hawks and owls known to feed chiefly on mice. P.33.
7. That the introduction of fish into the watershed be restricted to those parts of the river shown by the survey to be suitable for the species concerned. P.54
8. That owners of streams listed as suitable for speckled trout should be encouraged to improve them by constructing small trout ponds and by other methods. P.53.
9. That the fishing in any such impoundments be managed on a sustained yield basis. P.54.
10. That the Conservation Authority urge the Dominion Government to examine Smith Lake, Lambton County, with a view to safe-guarding its future as an important stop for migratory waterfowl. P.39.

<u>Recreation</u>

1. That the Township of Bosanquet consider the passing of a Zoning By-law, (pursuant to Section 406 of the Municipal Act of Ontario) for the control development and use of 8,970 acres of the Lake Huron Beach and "Pinery" area, as shown on the Recreation Map. P.17.

2. That three areas of beach and forest in Bosanquet Township, totalling 1,980 acres, be acquired and administered by the Conservation Authority for public use. P.18, 19.
3. That 370 acres of the Ausable River Gorge be acquired by the Conservation Authority for a park to be known as the Ausable Gorge Park. P.19.
4. That six small areas of from one to five acres be acquired for the public as picnic sites. P.20, 21.
5. That steps be taken by the Conservation Authority to educate the public to avoid the dumping of refuse and garbage on sideroads and beaches. P.21

Ausable Valley Report, 1949

TABLE OF CONTENTS

PART I ---- GENERAL

PART II ---- SOILS AND LAND USE

TABLE OF CONTENTS

PART III ---- FORESTRY

Ausable Valley Report, 1949

TABLE OF CONTENTS

PART IV ---- WATER

TABLE OF CONTENTS

PART V --- WILDLIFE

Ausable Valley Report, 1949

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

PART I - GENERAL

PART II - SOILS AND LAND USE

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS

PART V - WILDLIFE

PART VI - RECREATION

LIST OF MAPS

LIST OF MAPS

PART V - WILDLIFE

PART VI - RECREATION

Acetate Map of Municipalities (transparency) to be used for locating municipal boundaries, etc., on any Page Map in the Report

GENERAL

CHAPTER 1

LOCATION AND BOUNDARIES

The watershed of the Ausable River is an area of 665 square miles lying close to the eastern shore of Lake Huron, in the area between the cities of London, Sarnia, Goderich and Stratford. The watershed is, very roughly, oval in shape, with an excrescence of some size on the north-west around the villages of Staffa and Cromarty in Hibbert Township. It is bounded on the north by the watershed of the Bayfield River, on the east by that of the Thames, while on the south it borders on the drainage area of the South Sydenham River. To the west, the boundary follows that of the watersheds of various smaller streams and watercourses draining into Lake Huron, except for the section between the mouth of the river and Grand Bend. Here the boundary for several miles follows a range of sand hills along the lake shore, close to the beach.

A watershed has been defined as the high ground separating two river systems. Taken in this literal sense it becomes only a boundary line; but the term "watershed" is commonly used also to describe the area which is drained by a river and its tributaries. It is in this broader sense that the term is used in this report and, throughout the report, the terms watershed, drainage area, drainage basin and drainage unit are used interchangeably.

The main stream of the Ausable River rises in the neighbourhood of Staffa and flows, with many changes of course, southwest to Exeter. A little northwest of Exeter, where it is only about nine miles from the shore of Lake Huron, the Ausable turns south and flows in this direction for between twelve and fourteen miles. Near Ailsa Craig, the river begins a sweep to the west, describing a wide arc, with the centre approximately at Parkhill and a radius of

GODERICH
HURON
LAKE HURON
PERTH
STRATFORD
OXFORD
LONDON
MIDDLESEX
LAMBTON
ST. THOMAS
ELGIN
LAKE ERIE
KENT
AUSABLE RIVER WATERSHED

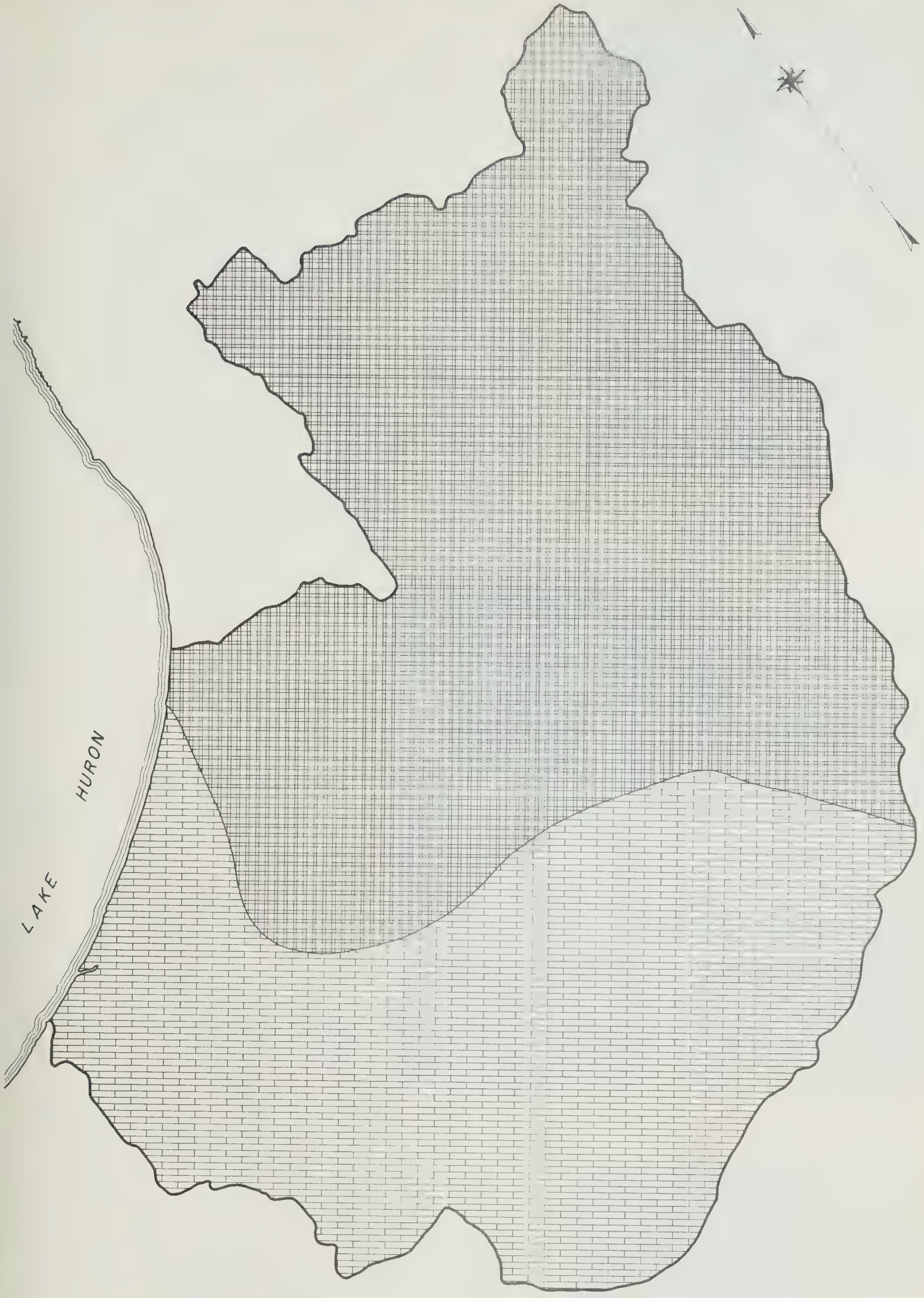
about seven miles. Near Arkona, it turns more sharply to the north and originally flowed in a northerly direction to Grand Bend, a distance of more than fifteen miles as the crow flies. Here, the river made a sharp hairpin bend and followed the line of the sand hills at a slight angle to its former course for some eight or nine miles before flowing through the sand-hills to the Lake near Port Franks.

From the source area near Staffa, on the extreme northeast to the watershed boundary on the southwest, beyond the village of Adelaide, is a distance of about 41 miles, while from the river's mouth on the west to the boundary beyond Denfield on the east, the width is about thirty miles.

The drainage area of the Ausable lies chiefly in the County of Middlesex, but also includes a large area of Huron County and smaller parts of Lambton County on the south-west and Perth County on the northwest. In Middlesex County, the watershed includes the whole of the townships of McGil-livray, Williams East and Williams West, the greater part of Biddulph Township and parts of Adelaide and Lobo Townships. In Lambton County, parts of Bosanquet and Warwick Townships are drained by the Ausable, as are the greater parts of Stephen and Usborne Townships, a large part of Hay Township and a small area in Tuckersmith Township, all in Huron County. About a quarter of Hibbert Township in Perth County lies within the watershed.

Parkhill in Williams West Township is the only incorporated town within the watershed, but Exeter in Huron County, an incorporated village, is the largest centre in the area. The other incorporated villages are Lucan, Hensall, Thedford, Ailsa Craig and Arkona. Crediton, though not sep-arated from Stephen Township is as large as several of the incorporated villages and has gained importance from the

Centralia Airport, situated between Crediton and the smaller village of Centralia. The summer resort of Grand Bend is probably more widely known than any of these places and during the season has a much larger population than any other centre in the area.



BEDROCK GEOLOGY

LEGEND

PALAEOZOIC

DEVONIAN

HAMILTON FORMATION Soft blue and grey shale and grey limestone

NORFOLK FORMATION Grey and brown limestone and magnesian limestone, calcareous sandstone chert, small quantities of gypsum.

SCALE: MILES

1 0 1 2 3 4 5

A surface stream drops into a sinkhole in the limestone.

Fossil bearing beds are exposed in the gorge near Arkona.

An oil drilling apparatus is a reminder of the importance of geology.

3. The Rocks

The accompanying map shows the distribution of formations found on the watershed and is based on a map[1] published by the Dominion Bureau of Geology. That part of the watershed which lies north-east of Parkhill and Ailsa Craig is underlain by rocks of the Norfolk formation. These rocks are mostly a hard, gray and brown limestone with some thin beds of bituminous rocks and calcareous sandstone. They have been used in the past for building stone and have a potential use for crushed stone. Rocks of this formation have also been used to produce lime. Within the region of this Norfolk formation salt has been obtained by drilling through the limestone to the underlying Salina formation.

The calcareous nature of these rocks is reflected in soil material. The glacial till deposits are calcareous and develop soils that are nearly neutral in reaction. The bed rock has very little effect on the surface relief.

The Southern portion of the watershed is underlain by rocks of the Hamilton formation. These consist largely of soft blue and gray shale with some gray limestone. These are exposed in the valley of the Ausable River at Arkona and in a brick yard at Thedford. The exposure at Arkona is a well known collecting place for fossils.

The manufacture of brick, hollow building blocks, and tile at Thedford is an important feature of the watershed. A supply of good tile in a region that requires so much underdrainage for soil improvement is fortunate.

Wearing action of glaciers on the shales of the Hamilton formation has contributed much clay to the glacial deposits of the region. The generally heavy soils

---

[1] J. F. Caley: Palaeozoic Geology of the London Area, Ontario, Canada, Department of Mines and Resources, Memoir 237, Geological Survey.

on the watershed are derived, to a great extent, from the shales and limestones of that part of the country.

CHAPTER 3

PHYSIOGRAPHY

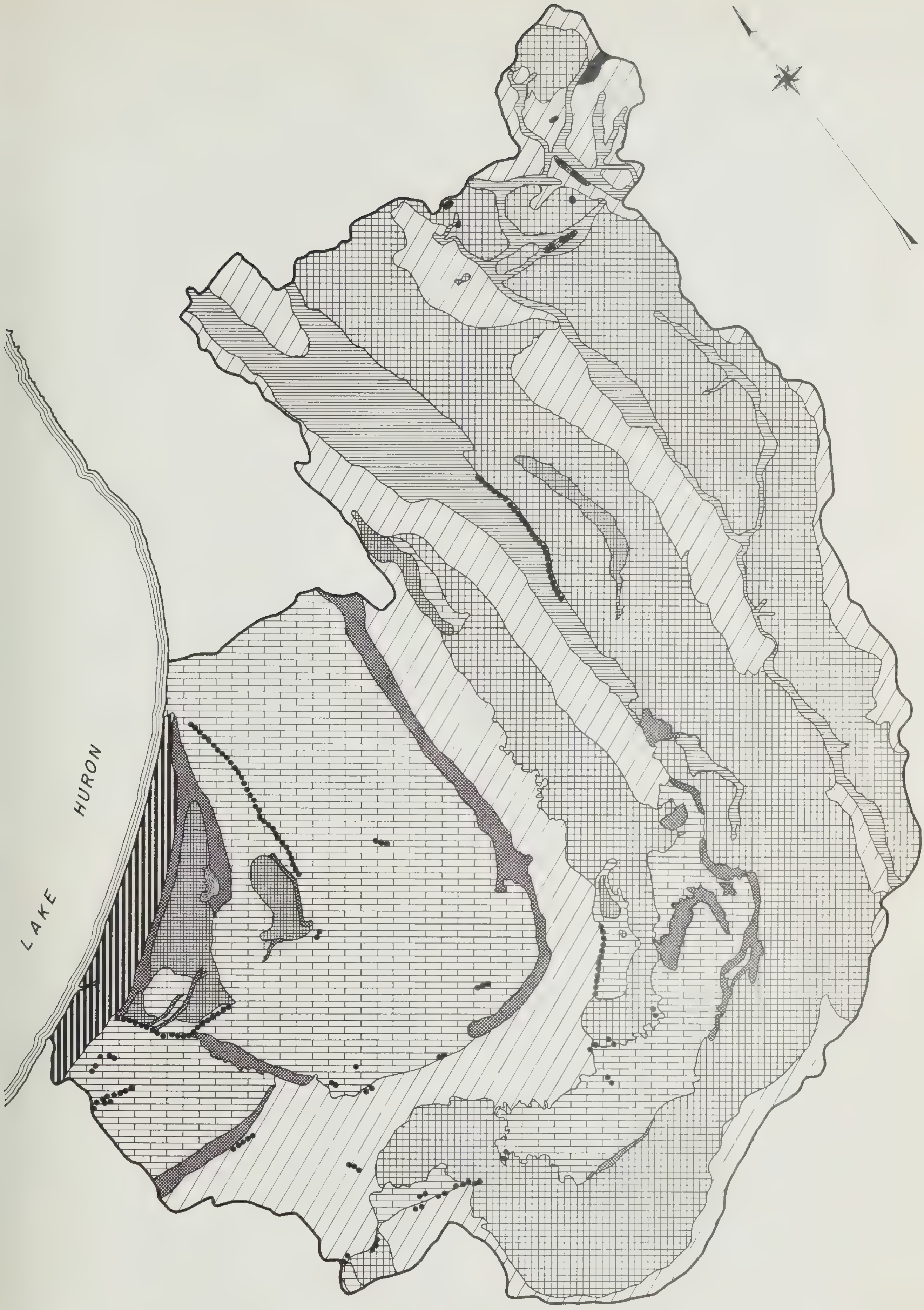
1. Surface Relief

The relief of the watershed is marked by two main features, a flat expanse near Lake Huron with elevations from six to eight hundred feet and an upland region with elevations from eight to eleven hundred feet above sea level. The flat country consists of post-glacial deposits of sand, silt and clay or of glacial deposits smoothed and veneered with clay by water action. The upland region rises from west to east but is marked by a north-south ridging, of morainic character, which causes stream flow to conform to it rather than in the westerly direction in which the average slope tends. The river cuts through the most prominent of the north-south range of hills near Arkona. Dissection of the hills by the main stream and some of its tributaries gives the boldest relief on the watershed.

2. Glaciation and Land Forms

The vast expanse of ice which covered the northern part of North America in the last geologic age covered southwestern Ontario and gave it its present form. During the last movement ice was pushed around the highlands of Dufferin and Grey Counties in two lobes. The westerly lobe shaped the land on the Ausable Watershed.

Material deposited under the ice as it moved is called ground moraine. In this region it was spread out to form generally smooth topography and constituted a "till plain". Halts in the movement of ice front are marked by elevated ridges with rougher surfaces called end moraines. In this report they are termed merely "moraines". Moraines formed at a retreating ice face are called "Kame moraines". These are sandy or gravelly while the others consist of clay and boulders.



PHYSIOGRAPHIC AREAS

LEGEND

TILL PLAIN
MORAINE
SPILLWAY
BEACH
SAND DUNES
LAKE PLAIN
KAME MORAINE
PEAT BOGS AND MUCK

SCALE: MILES

1 0 1 2 3 4 5

When glaciers melted the water ran away through channels cutting quite large valleys. These are broad with steep sides and have flat, terraced floors called "Spillways". In the large post-glacial lakes clay, silt and sand were deposited to form "clay, silt and sand plains". At the margins of the lakes gravel "beaches" were formed. These lie inland from the present Lake Huron.

Rivers and meltwater channels debouching into post-glacial lakes made deposits of sand called "deltas". In some places the till plains were smoothed off and the material re-sorted to give a flattened till plain with a superficial covering of clay. These are called "clay veneer plains".

There are deposits of silt lying over the heavier material on the moraines and till plains of the uplands. This silt is believed to have been deposited by the action of wind. On them a different soil is formed than that on the water-laid silts.

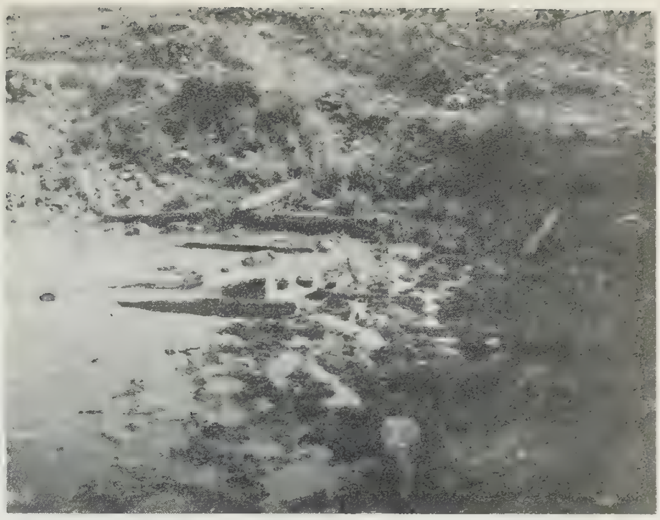
Some of the depressions in the rougher topography, old lake beds and floors of spillways, have an accumulation of decayed organic matter over the mineral material. The less decomposed deposits are called "peat" and the more decomposed are called "muck". Flood plains at the bottom of river valleys covered with recent deposits are termed "bottom land".

All the glacial and recent land forms mentioned above are found on the watershed. Their extent and distribution is shown in the physiographic map accompanying this report. They are described in the following paragraphs, and the mapping symbols by which they are indicated on the soils map are also given.

3. <u>Kame Moraines (K)</u>

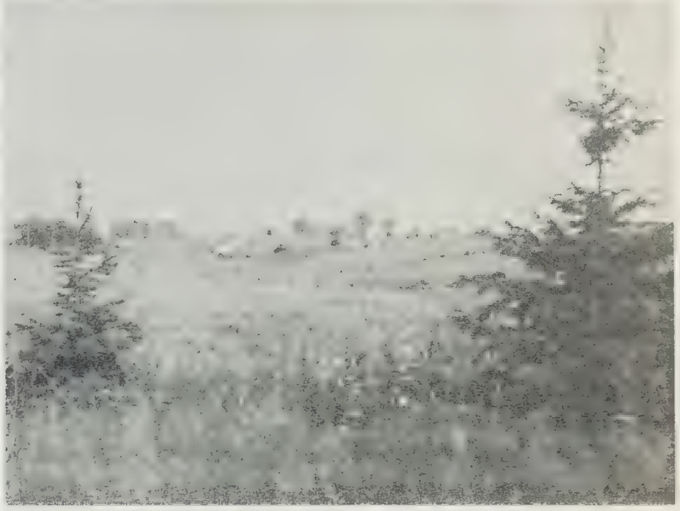
The northeastern lobe of the watershed around the villages of Staffa and Cromarty includes small areas of

"Kame" topography near Staffa.



A spring at the base of a kame moraine near Staffa. Springs in this locality give rise to the main stream of the river.

Typical landscape on till plain near Farquhar.



View of a moraine. Note the steep slopes and the hummocky topography.

Stratified sand and gravel in a beach formation. This is near the "Pinery" road.

Farm land on the old lake plain. This soil is a water-laid clay veneer on a till plain that has been levelled by water action.

Kame moraines. These are in the form of prominent hillocks made up of roughly stratified sand and gravel. Many have been worked for the sand and gravel in them. The lower slopes are often cultivated but the higher parts are drouthy, and usually left in grass cover for pasture and hay. As the material is porous, water percolates freely through it and issues down-slope as springs, which are sources of the river. In the interests of water conservation these might better be re-forested. Trees are a crop well suited to this light soil, possibly better than the hay or pasture they now support. From the point of view of water conservation trees are probably the most advantageous cover.

4. Clay Moraines (TM)

The most prominent physiographic feature of the watershed is the series of ridges of higher land. There are three major ones which run roughly north to south from the northern part of the watershed. The most westerly of these enters the watershed north of Khiva, runs south to enter Williams Township and then swings westward south of Parkhill. The others have the same trend westward but their south-westerly branches extend beyond the watershed.

The soil material of these ridges is similar to that of the lower land lying between them and consists of a heavy clay. It is as if the glacier had passed over a fairly level expanse of clay and had crumpled the land up into ridges in places. For the most part these upland ridges, or moraines, have rougher topography than the land between. This is not always so but where such a formation is seen to be part of a moraine system it has been mapped as a moraine. The land use features of moraine country are characteristic of rough topography and the differences between moraine and till plain mentioned in this report apply to the average conditions.

These morainic ridges have important effects

on the land use and on the river itself. The more irregular relief in the moraines effects land use in two ways. The slopes may be too steep or rough to cultivate or have been subject to accelerated erosion under cultivation. The depressions between the hills are often inadequately served by surface drainage channels. The compactness and texture of the material of the moraines restricts internal drainage. The depressions therefore contain cold, wet soils not suitable for cultivation of crops unless artificially drained. Single line tile drains are common throughout the areas of moraine to overcome this handicap.

The flow of the Ausable River itself and of its tributaries is very strictly controlled by these moraines. The main streams flow southward inland from these ridges. They are fed by tributaries which flow into them at right angles from the slopes on either side. In some places tributaries have, by headward erosion, cut back through the ridges and "captured" a parallel main stream. An example of this is seen in the stream which flows out of Hibbert Township. Instead of flowing down past Elimville, it turns at a sharp elbow to flow west past Exeter to join another main stream.

Run-off from the westward slope of the moraine is carried by the Parkhill creek and a number of small streams into the lower Ausable between Thedford and Grand Bend.

The Little Ausable cuts through a moraine near Clandeboye and joins the main Ausable. It is interesting to note at this point that the Little Ausable runs through less clayey country and the water is quite clear. The main Ausable carries much silt and mud washed from clayey slopes. Past the juncture of these two streams the river flows along the southern margin of the largest moraine until, near Arkona, it swings northward to cut a deep valley in the moraine.

5. Spillways

When the glaciers melted there was more water released than could be carried in any existing channels. The meltwater flowed down slope along the edge of the glacier and cut out wide deep valleys. These valleys are floored with gravel, sand and silt which are the heavier components of sediment carried by the water and first to settle out. Whereas the moraines stand above the general level of the till plains, the spillways cut depressions through them. The spillway valleys mostly remain as broad and flat-bottomed but some tributary spillways are in the shape of a broad "V" in cross section.

There are three main features of spillways that are important in a conservation program. First, the soils are coarse textured and of little value except where covered by muck. Second, the north-south streams of the system are confined to the spillways. Third, the valleys are much too big for the streams that now flow through them. These streams are called "misfits". The land in the bottoms is therefore inadequately drained. Though the wider spillways have, in the past, had much money spent on draining them, they remain of very little use to agriculture except in small areas where muck deposits have been exploited for cash crops. There are practically no buildings on these valley floors. Poor pasture or non-commerical forest is the main cover.

In many parts of southwestern Ontario spillways similar to those on the Ausable are remarkable for the dense cover of white cedar over large areas. Some wooded areas cover thousands of acres. They are very obvious either on travelling through the country or on viewing topographic maps or aerial photographs. Differences in aspect and use of spillways depends on whether they have been artificially drained or not. Insofar as those that have been drained are

still of little agricultural use while the undrained ones have useful forest cover it would seem that drainage is not warranted.

6. Till Plain (T)

Lying between the moraines and occupying the greater part of the watershed remote from the lake is the till plain. It is broken into long strips by the moraines but these strips are wider than the moraines themselves. The material of the till plain is similar to that of the moraines but the surface relief is usually less rugged and the altitude is a little below that of the moraine.

The soil material of the till is heavy clay loam. It contains few stones and boulders. Because of the underlying limestone rock the stones and pebbles are mostly limestone. The heavy, clayey nature of the material is believed to be due to its mode of deposition. The glacier moved over and worked up material which had previously been deposited by water. This heaviness of the soil has two important features. First, internal drainage is too slow to accommodate water which is not carried away by surface drainage. Second, through cultivation or long use as pasture the soil becomes even more compact and does not offer a favourable medium for the growth of crops.

On both the moraines and till plains there are, in places, deposits of silt. The silt may be a few inches or even three feet in depth. The origin of this silt is not certain, it may have been deposited by wind after the decline of the glacier and before the soil had acquired a covering of plants. The soil developed on the silt is similar to that on the heavier material but there are some aspects of its use which have raised problems. The silt soils are shown separately on the soils map and are discussed in more detail in the Soil and Land Use Section of this report.

7. Beaches (B)

When the glaciers melted there were, in the basins of the great lakes, much larger lakes than are present now. There were also bays and smaller lakes which no longer exist. These larger bodies of water, the post-glacial lakes, were caused by three things. First, the extra water from the melting of the glaciers, second, the restriction in the movement of the water to the ocean by masses of ice still covering the outlets of the St. Lawrence system and, third, the settling down of the continent under the weight of ice. With the release of glacial meltwater and the lifting up of the continent the smaller lakes disappeared and the lake in the basin of Lake Huron diminished. Abandoned beaches at the shores of these old bodies of water remain.

Some of these beach formations are long, narrow strips of light, gravelly material and boulders. Some of these are indicated on the map by a symbol consisting of a row of small circles. The larger ones are of wider extent and their areas are outlined on the map.

The beaches mark the boundary between the upland portion of the watershed, consisting of moraines and till plain,and the low flat portions, consisting of spillways and lake plains.

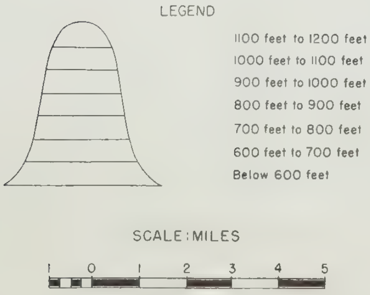
The coarse textured soils and the presence of boulders lowers the agricultural value of the soil on the abandoned beaches. Where poorly drained soils lie adjacent to the coarse soils the latter are then prized for their one favourable feature of good drainage and warmth.

8. Lake Plains

The lake plains may be as flat as originally laid down or they may be dissected by sharp V-shaped valleys formed by the river system. The western part of the watershed consists of lake plains that reach to the margin of Lake Huron. There were embayments in the old post-glacial lakes and also

LAKE ELEVATION
581 FEET
LAKE HURON
MANY DEPRESSIONS

CONTOURS



LEGEND
1100 feet to 1200 feet
1000 feet to 1100 feet
900 feet to 1000 feet
800 feet to 900 feet
700 feet to 800 feet
600 feet to 700 feet
Below 600 feet
SCALE: MILES
1 0 1 2 3 4 5

inland ponds the floors of which remain in the form of lake plains.

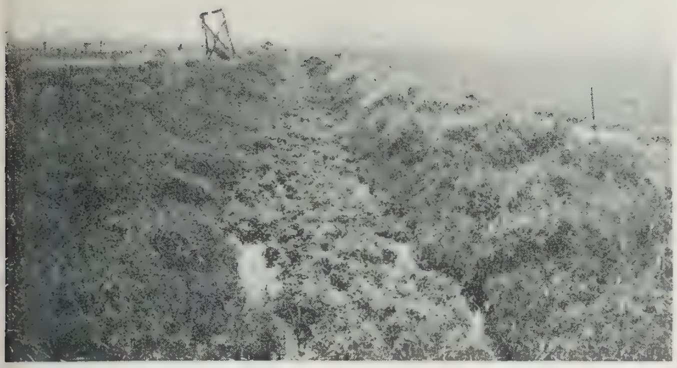
The material on the lake plains is varied. Inshore deposits are sandy, deposits formed in deeper water are clay. An intermediate texture is silt. Sometimes sand or silt may be found lying over clay. Much of the flat land of the lake plain consists of a clay veneer over till material that was smoothed over by water action. To a lesser extent sand or silt is found lying in thin deposits over till.

The flat terrain of the lake plains has poor surface drainage. When the material is clayey the internal drainage is also poor. Where the river system has cut deeper valleys in the plain and drainage is thereby provided, the lighter materials are well drained. Where the sand plain is cut by drainage channels, the soil is too dry. In the flattest areas with no well established surface drainage, the sands and silts are inadequately drained as well as the clays.

Where the land is flat adequate artificial drainage is the chief problem, where steep slopes are found accelerated erosion occurs when the soil is cultivated. Fruit growing is common on the well drained sands. Where the flat land has been artificially drained there has been a wide and intensive development of cash cropping of wheat, beans, soybeans, beets and garden produce. The richest soils and much of the most advanced and specialized agriculture are on the lake plains.

9. Recent Deposits of Muck and Peat

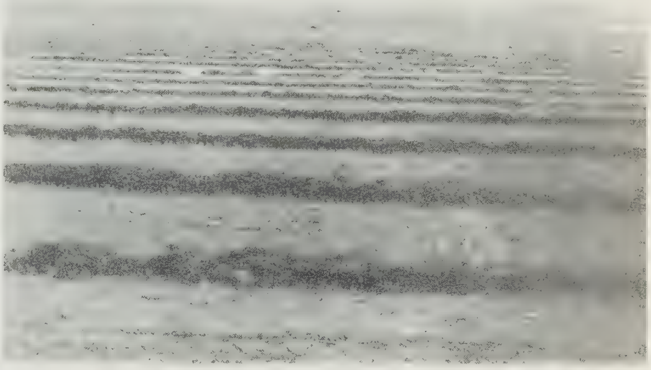
In flat depressions on the lake plains and in some of the larger depressions in the uplands, there are fairly deep and extensive deposits of decayed organic material. When the water table is permanently at the surface the accumulated remains of thousands of years of vegetation has not decomposed very much and they remain in the form of peat. When the water table fluctuates and organic remains (humus) are



The Little Ausable, a misfit stream on the broad, flat floor of a spillway, has been channelized in this ditch.

Near Lucan a tributary of the Little Ausable has cut through a moraine. Stones and boulders from the soil remain to form a pavement on the river bottom.

The sloping edge of a moraine with the flat floor of a spillway in the foreground. Note poor crop responses on eroded slopes. This kind of land would respond favourably to erosion control practices.



Imperfectly drained clay soil on the old lake plain. This kind of land lends itself to large scale mechanized farm operations as seen here.

A wide view of the Thedford marsh area shows cultivated, waste and wooded land.

Near Arkona the sand plain has steep valleys cut into it by streams. The soil and location are found favourable to the growing of orchards and small fruits.

regularly aerated, decomposition has advanced further and muck is found.

Lakes and bogs have been artificially drained since the first settlement of the area and the land now consists of muck deposits which are worked for garden crops, celery, mint, onions and beets as well as the same cash crops commonly found on the lake plain.

10. Sand Dunes

A large area of sand dunes, known as the "Pinery," stretches from Grand Bend to Fort Franks. The sands of abandoned beaches and recently elevated lake plains have been worked into dunes by wind. When these sand dunes have acquired a cover of forest they have become stabilized. Lack of fertility precludes agricultural development of this kind of land. Lumbering in the past and recreational use in the present constitutes the land use picture of the sand dune area.

CHAPTER 4

LAND SETTLEMENT

1. Exploration and Settlement to 1840:-

The pattern of settlement in Upper Canada was largely determined by the trade routes, used during the French period to reach the Upper Great Lakes. As a result, the Ausable and its tributaries remained almost unexplored until well into the nineteenth century. The main southern route was by Niagara and Detroit, but the early traders and presumably also the Indians, almost invariably preferred to coast up the western side of Lake Huron, rather than up the exposed eastern, or "lee" shore. The more direct routes by the Ottawa, Trent and the "portage of Toronto" all passed far to the northwest of the area. Champlain is said to have camped near the present site of Goderich in 1615, but after that time the region remained almost unvisited except by a few missionaries and traders.

It seems very likely that the Neutral village visited by the Jesuit Missionaries Bréboeuf and Chaumonot in 1640-41, and named by them St. Francois, was on or near the River Ausable. It has not yet been possible to fix the site of this village, but a map of 1656, based on information obtained from the Jesuits, marks St. Francois in this general region. A hunter from the French Settlements near Detroit told a tale in 1820 of having found "on the Aux Sables, forty miles northeast of Sarnia" the ruins of a large European habitation with old trees growing in it and a stone fire-place and chimney at one end. This has been identified as a Jesuit Mission at St. Francois and there are persistent rumours in the neighbourhood that such a chimney still exists in some unidentified location in the southwest part of the watershed and has been seen in recent years.

If this Mission ever really existed, it was not

founded by Bréboeuf and Chaumonot, who were alone in an unfriendly country in 1640 and in no position to found missions or build large houses with stone chimneys. After Bréboeuf's failure with the Neutrals, the Jesuits sent no more missionaries to them, at least until after 1643, when the ground had been prepared by Indian Converts, so that any Mission on the Ausable must have been destroyed within a few years when the country was swept by the Iroquois and Neutrals, Hurons and Jesuits driven out.

The French explorers must have sometimes visited the mouth of the river, when they happened to follow that shore of Lake Huron. Dollier and Casson do not mention it in their account of their explorations, but showed the lower part, not inaccurately, on their map (1670). The French called it the "Rivière aux Sables[1]", and perhaps sometimes used the Indian Trails, which are known to have crossed the area from Lake Huron to the Thames. At any rate, there had been some exploration of the region before 1800, but little information about the river and its valley seems to have been available, and the course of the river shown on a few eighteenth century maps is obviously conjectural and much less correct than the part shown in 1670.

By this time, the Chippewas had taken over this part of the country, having gradually penetrated into it after the destruction of the Hurons by the Iroquois. They had built up an extensive trade in flints, which are found in large numbers around Kettle Point, just south of the watershed. These flints were in demand with distant tribes and an important trail - the "Flint Trail" from Kettle Point to the "Forks" of the Thames (London) - must have reached the river

---

1. The present official spelling of the river's name is Ausable. However, there are many variants still in use, such as Aux Sables, Aux Sable, Aux Sauble, Sable, Sauble and Au Sauble. The Chippewas called the river Nagansippi.

below Arkona. There were Indian Corn fields[1] on the river, near Highway No. 7, in 1826, and there seems to have been a Chippewa village not far off for some years after this. "St. Francois" may also have been in this section for the Indians liked locations near river flats where corn could be grown without trouble. The Indians were also in the habit at some seasons of portaging to the Ausable at Grand Bend, paddling up stream to a point near Nairn and travelling overland to the Thames.

After the war of 1812-15 had emphasized the exposed nature of the water route from Detroit to Niagara, the military authorities were looking for alternative water routes, less exposed to attack, which might be improved to allow the use of batteaux and large boats. The building of the Rideau Canal was the chief result of these investigations; but several other rivers were surveyed and some rumour of a short cut from Lake Huron to the Thames by the "Rivière aux Sables" must have reached Quebec. In September 1819, Lieutenant H. Willson, Royal Engineers, stationed at Amherstburg, made a careful survey of the river from the mouth to near the present junction with Parkhill Creek.

Willson's report appears to have been pigeon-holed in the military archives at Quebec and forgotten for the later surveyors knew nothing of it. The shore of Lake Huron was surveyed between 1819 and 1824 by Lieutenant H.W. Bayfield, R.N., for the Admiralty, but it was not until the preliminary agreement with the Chippewas purchasing the region for the Government had been signed in April 1825, that white men began to penetrate the area in any numbers.

---

1. Mahlon Burwell camped "near the corn fields" on October 6th, 1826, and made a short day's journey from thence to Townsend's location, a mile or so east of Arkona, the next day, (after 10:00 a.m.) "according to the winds of the Sable".

2. <u>The Beginning of Settlement 1820-1840</u>:-

The portions of London and Lobo Townships which fall within the Ausable Watershed were settled much earlier than the remainder of the area. The northern parts of these townships were surveyed in 1819 and 1820, and the first grant of land registered in the watershed to Mahlon Burwell, Deputy Land Surveyor and Crown Agent in the Talbot District, dated November 21, 1820. The lots, which were in Concession XII and XIII of Lobo Township, were undoubtedly in payment for surveying the area[1], and may not have been occupied for some time.

Other grants soon followed; patents for 5,400 acres in the Lobo Township portion of the watershed had been issued by 1830, and for 500 in the London Township portion. A lone pioneer, Asa Townsend, had gone deep into the wilderness in 1821, to build his cabin on the banks of the Ausable near the present southwest corner of Williams East, where he hoped to develop a salt spring into a commercially profitable enterprise[2]. Townsend remained on his "location" for some time; his salt drilling eventually came to nothing, after he had gone down 264 feet with primitive water driven drills---234 feet through solid rock[3]. He was granted patents for his land in 1834.

In the meantime, the Government's land policy

---

1. Crown Land Papers, Canada Company, Ridout to Hillier, March 17th, 1827; "Surveys are now generally performed by contract, the Contractor being remunerated in Land at the rate of 2½ to 6 per cent for each 100 acres surveyed according to the quantity thereof". (In Ontario Public Archives).

2. Townsend had settled first in the Westminster Township in 1812, brought in by Simon Zelotes Watson, who cheated him and finally threatened to keep him off his land even if he had to kill him. It may have been partly fear of Watson which drove Townsend so far from settlements. Petition of Asa Townsend, 24 April 1812, U.C. Sundries, Ottawa Archives.

3. Diary of Mahlon Burwell, Chippewa Indian Reserve Survey, 1826.

was being considerably modified. The practice of granting land to settlers on payment of fees had for some time been unsatisfactory from the point of view of the Government of Upper Canada which got very little revenue and a good deal of expense from the system. In the most of townships laid out up to 1824, one seventh of the lots had been reserved to the Crown, and an equal number for the support of the Protestant Clergy. No very practical method of obtaining revenue from these reserved lots had been devised; the newspapers of the time abound in sheriff's notices regarding arrears of rent on leases of Crown Reserves, to which the lessees appear to have paid little attention. Moreover, a settler was not likely to lease a lot from the Crown Reserves when he could get a cheap freehold elsewhere. By 1826, after considering a series of proposals, the Home Government had decided on the virtual abolition of "free" land grants[1]. Henceforth, all land was to be sold, either for cash or on the instalment plan, except to military claimants, who continued to receive free grants for a time. A Crown Lands Commissioner was appointed in 1827 to implement the policy.

This decision raised some practical difficulties; during discussions of the situation the Government had shown a marked dislike for the necessity of entering the real estate business, which would demand a staff, accounts and auditing, and would undoubtedly have political reper-

---

1. Actually the original grants were hardly "free" grants except in special cases, since the various fees amounted to from £15 to £20 for 100 acres. However, since most of the fees were remitted to Loyalists and their families, to military claimants and to others at the Governor's discretion, a large proportion were free up to about 1820. The price of wild land under the new system was not much higher than the total of the old fees, but by reducing the number of officials concerned with the issue of patents and stopping most of the special free grants, it was possible to get some revenue from the sale of Crown Lands.

cussions from time to time. This reluctance resulted in another parallel development.

In 1823, John Galt, who had visited Upper Canada as a member of the Royal Commission on War Losses, proposed the formation of a company to take over the sale of unassigned land in the colony. The Government saw in Galt's proposal a means of ridding itself of the political and material nuisance of the Reserves, but shied away from the idea of granting a land monopoly to a commercial group. Galt's original idea of taking over all land sales had to be modified, and his company, when formed, was to supplement the Crown organization. After a good deal of negotiation, it was agreed that 1,384,413 acres of the Crown Reserves and 829,340 acres of the Clergy Reserves would be sold to the Canada Company for subsequent resale; this constituted all the remaining Crown Reserves and one half the Clergy Reserves in those townships which had been laid out up to March 1824[1].

However, the commission charged with the valuation of the lands set a price of only 3s. 6d. per acre, which proved unacceptable to the Clergy Corporation. The problem was eventually solved by dropping the Clergy Reserves from the scheme altogether, and substituting a tract of 1,000,000 acres of wild land to be chosen from the region just purchased from the Chippewas. This was later increased by 100,000 acres to make up for swamps, ponds and other unsaleable areas (principally the Ellice Swamp). For this vast tract, the company was to pay £145,150 5s., the price originally set for the smaller area of Clergy Reserves[2], and

---

1. Land Settlement in Ontario. (Sixteenth Report of Ontario Dept. of Archives, 1921). A large acreage of Crown Reserves were granted to King's College (University of Toronto) and some to other institutions in 1826.

2. Many of the Clergy Reserves lay in old settled areas and had been "improved". The average value was higher than that of remote "wild" lands.

one third of the purchase price was to be remitted, on the condition that the money be spent on "canals, bridges, high roads, churches, wharves, schoolhouses and other works undertaken and calculated for the common use and benefit of His Majesty's subjects resident within that part of the Province of Upper Canada [1]". Estimates for work of this nature had to be approved by the Governor-in-Council before it was begun, and the costs were to be credited to the company by Order-in-Council on completion. The company's charter was issued in August 1826, and still remains in force, as modified by subsequent agreements.

The settlement of the Ausable Watershed, therefore, was conducted under two systems. After 1826, Lobo, London, Adelaide and Warwick Townships were settled under the new Crown Lands Regulations, while the remainder of the watershed was developed as a commercial enterprise by the company.

Real explorations of the tract started in September 1826, when Mahlon Burwell set out to survey the boundaries of the two Indian Reserves specified in the treaty with the Chippewas. He is the first white man to penetrate the area since 1819, who has left full records. After marking the boundaries of the Kettle Point Reserve, Burwell decided to run a line from near Townsend's "location" to the shore of Lake Huron, in continuation of a survey made from the northwest corner of Lobo to Townsend's in 1824 by Rosewell Mount [2], thus fixing for the first time the distance

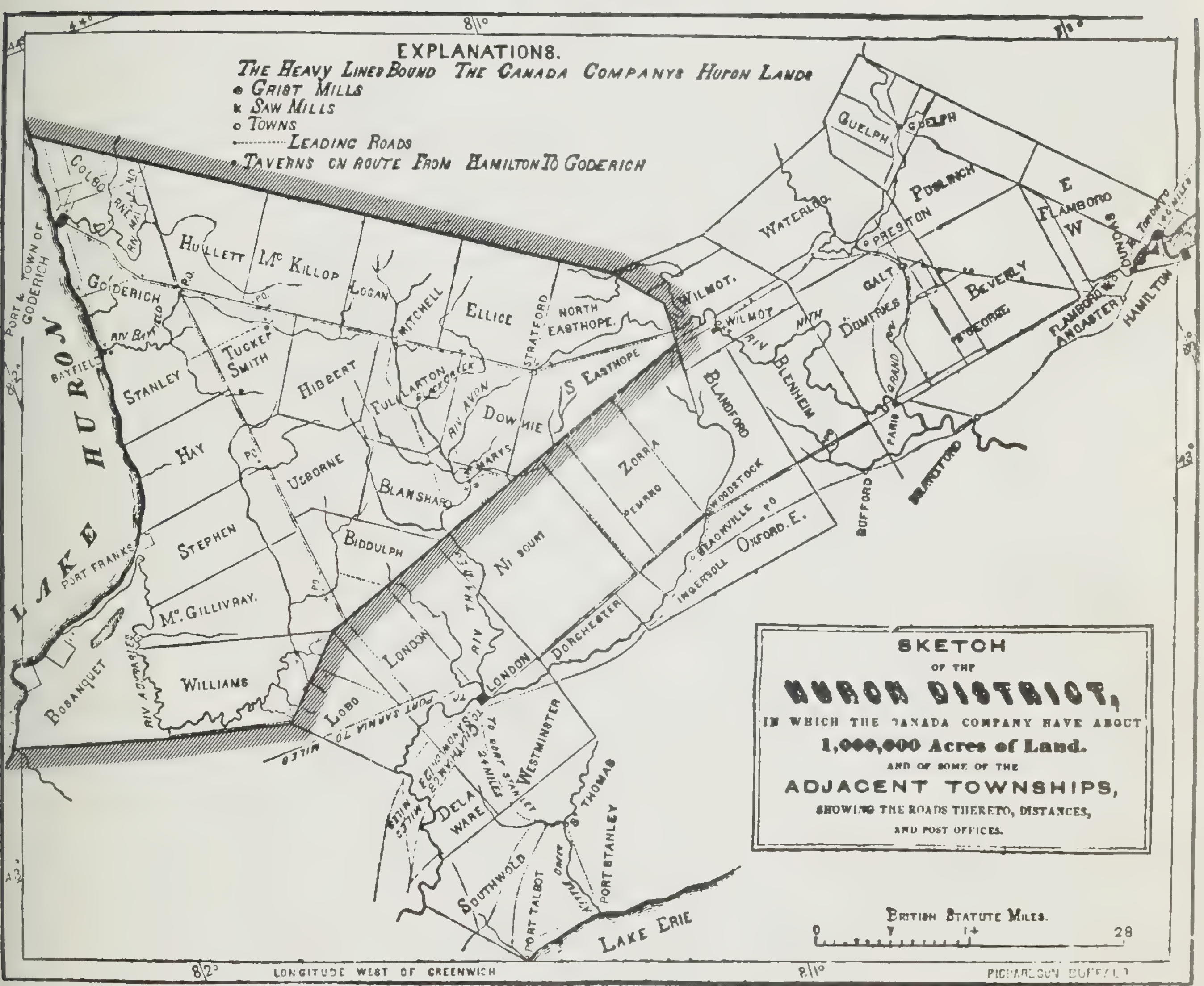
---

1. Agreement between the Crown and the Canada Company, 1826.

2. Townsend's petitions to the Executive Council of 1821 and 1822 state that he has cut a "waggon track" in to his location from Lobo; this presumably is the line later surveyed by Mount, and follows the present road along the south boundary of Williams Township to Arkona and Forest. The Canada Company's Map of 1849 shows a road along the Williams-Lobo Townline turning up to the Ausable at Townsend's location.

TORONTO GLOBE: 1848-9

The Map was drawn about 1845



LANDS IN CANADA WEST (LATE UPPER CANADA).

THE ATTENTION OF

EMIGRANTS, OLD SETTLERS AND OTHERS,

IS INVITED BY THE CANADA COMPANY TO THE

HURON DISTRICT,

CONTAINING ABOUT

ONE MILLION ACRES OF LAND,

IN ONE BLOCK,

Extending Westward from the Gore and Wellington Districts to the Shores of Lake Huron, which bounds it for sixty miles.

The Land in the Huron Tract is of the finest character, and of the description best adapted to the cultivation of Wheat. This Tract possesses advantages which render it peculiarly eligible to every class of Settler: scarcely a bad Farm is to be found in it: it is well watered by living Streams, and the climate is most healthy. The principal Port is Goderich, the District Town, which has a population of about 1200—good Stores or Shops, Mechanics, a large Grist Mill, a Fulling and Carding Mill, an Iron Foundry, places of Religious Worship, resident Clergymen, and good Schools, where the higher branches of the Classics are taught, &c. &c. &c.

between the Thames and the lake, and incidentally a rough southern boundary for the Huron Tract. It was on this trip that he "discovered" the lake, already found in 1819 by Lieutenant Willson, which is still called by his name, although drained in 1875. He also "scaled" the shore of Lake Huron as far north as the Indian carrying-place at the present site of Grand Bend.

The Canada Company, meanwhile, had indicated the area which it wished to develop. It included the present townships of Colborne, Hullett, McKillop, Logan, Ellice, Easthope North and South, Goderich, Tuckersmith, Hibbert, Fullarton, Downie, Stanley, Hay, Usborne, Blanshard, Stephen, McGillivray, Biddulph, Williams East and West and Bosanquet, all of which take their names from directors of the Canada Company, or from men in public office at the time. John Galt, after organizing affairs with respect to the Crown Reserves in the older townships, began to assemble a party to explore the Huron Tract and fix its boundaries. For this, he secured the services of Burwell, who knew the area, as well as those of John McDonald, who did most of the subsequent surveys for the company. The group set out in June 1827 from the township of Wilmot, and reached the lake near the mouth of the Maitland. Burwell completed his survey of the lake-shore down to Grand Bend, and he and McDonald laid out the area around the mouth of the Maitland.

By December 1828, Galt was able to report to the Surveyor-General that a sleigh track was open from Wilmot to Goderich, and that taverns were "being erected[1]". His next step was to have a road surveyed from the present site of Clinton to connect with the "Proof Line Road" in London Township, along the route of the present No. 4 Highway. This

---

1. Galt to Surveyor-General, Crown Lands Papers, Ontario Public Archives.

survey was largely done in 1829, and the last few lots were laid out in 1830-31. It was from this road that settlement spread into the portion of the watershed owned by the Canada Company. In the meantime, another group was making an accurate survey of the course of the Ausable from Townsend's property to its mouth, this being completed in December 1828. Williams East and West were surveyed in 1831.

The exploring parties were amazed at the richness of the country. Dr. William Dunlop, who later became the first M.L.A. for the Huron District, reported on the 1827 expedition in glowing terms. He says that "the soil is uniformly of the loamy character, rich and free to work[1]". He adds that there are enough streams for "every farm to be furnished with a share of one ----- though it is to be expected that in the course of cultivation many of these will be greatly impaired or perhaps totally dried up -----[1]". Dunlop describes the black ash swales as "wet in the spring and autumn, but tolerably dry and producing good grass at midsummer[1]"; he states that they do not require drainage - clearing and opening to the air being sufficient to make them "fit for the plough". Most of the region was covered with mixed hardwood forest, but there were large stands of pine, notably on the sandy land drained by the lower Ausable[2].

With the opening of the region well under way, settlers began to follow the trails blazed by the survey parties. Adelaide and Warwick Townships were surveyed in 1832, and groups of settlers came out under the auspices of the Earl of Egremount, in addition to others who settled on

---

1. Brymner, D., Report on Canadian Archives, 1898, p.9 et seq.
2. The timber in the "Sand Hills" area was noted as being of poor quality, however.

militia grants[1]. A large party arrived in the area around what was to be Adelaide Village in the summer of 1832, and since many of them were well-to-do, clearing proceeded rapidly. The village itself was laid out in February 1833, and the surveyor notes that there were two houses, a general store and a Government store and office already in existence at the time[2]. The group of retired officers, who were the prime movers in the Adelaide scheme had grandiose plans for the village, including a Club House, an Opera House and several other buildings, which never materialized. Much of the development was supervised by Rosewell Mount, Crown Agent and M.L.A. for Middlesex; by 1835, his account for settlement in Adelaide, Warwick and Caradoc included items of £2,915 for roads, £2,630 for supplies (sold, presumably to settlers, through the Government store), £948 for housing immigrants, to Adelaide and Warwick and £218 for hospital expenses in Adelaide and Warwick[3].

Most of the first group had completed settlement duties by 1836, and patents had been issued for nearly 10,000 acres in the part of Adelaide falling within the watershed. There were also ten or twelve farms in the small portion of Warwick drained by the river.

Proportionately, settlement in the Huron Tract was somewhat slower, although some areas received as many immigrants as Adelaide and Warwick. The cholera epidemic of 1833-34 cut down the influx very considerably; on the other

---

1. The Governor, Sir John Colborne, was in the habit of recommending "respectable" immigrants to settle in Adelaide in the early thirties, though some people thought this a mistake - Langton Letters.

2. Diary of P. Carroll, Deputy Land Surveyor, 1833. Dept. of Lands and Forests, Toronto.

3. Report of the Select Committee on Grievances, Legislative Assembly of Upper Canada, 1835. Freeman Talbot of London built many of the houses by contract in 1835. Most of the civilian settlers came from Ireland.

hand, the intensive advertising campaign of the Canada Company tended to attract settlers. The company's early policies were calculated to induce speedy settlement; land was sold freely on the instalment plan, and the survey had marked out 100 acre lots, rather than the 200 acre ones of the older townships. The smaller farms were easier to pay for, principally because the small profits of the early years were not eaten up in payments for a large proportion of uncleared land[1]. It is note-worthy that of 365 land sales made by the Canada Company during the first ten years of settlement in the Ausable Watershed, only 28 were for cash. Of 72 sales of 150 acres or more, 31.9 per cent were in arrears after their first one or two payments, and the land had to be sold or abandoned. On the smaller farms, only 24.2 per cent of the settlers were so unsuccessful as to be forced to sell or abandon their property[2]. This does not imply that the majority found it easy to make a living. Many farms settled between 1830 and 1839 remained unpaid for until the good times of the 1850's, and interest on arrears of instalments in some cases amounted to as much as the instalments themselves.

Other policies of the company were mixed in their effect. The fact that they undertook the building of roads (an enterprise beyond the means of the small groups of early settlers and usually neglected by Government) hastened settlement. On the other hand, the roads were undoubtedly too costly -- the two main roads, stumped but not surfaced,

---

1. This plan also made settlement more compact and hastened the opening of roads, since the lot had only one quarter mile frontage on a concession road, instead of two.

2. Statistics calculated from Canada Company Records in Dominion Archives.

cost £265 per mile[1] -- and, since the agreement with the Crown called for the expenditure of a fixed sum on improvements, this meant that the Huron District got fewer miles of roads than it would have under a proper system of letting contracts by tender. Similar difficulties arose in the case of the mills, which were so essential to the rural economy. The Canada Company had been given the monopoly of "mill privileges", as was usually the case in settlement schemes of this type. The company established mills very early and in fair numbers, but the proportion of grist mills was not high enough to satisfy the settlers. In its anxiety to exploit the mills, the company usually preferred to build and rent mills rather than to sell or lease mill privileges. In 1840, of the eight to ten grist mills or sawmills in the Huron Tract, only two were not owned by the Canada Company[2]. In one instance, however, the Canada Company overreached itself in its desire to control milling. Two Americans, Brewster and Smart, had purchased 2,335 acres of land, including three mill sites, in Bosanquet and Williams Townships in 1835. Their mill, just south of the present town of Grand Bend, seems to have been in operation from 1832, since interest is charged on the purchase money from that year. The Canada Company, anxious to maintain its monopoly in lumber, made a contract with Brewster and Smart in which they agreed to purchase their "entire output". The enterprising Americans immediately proceeded to Detroit, where they bought two more saws and hired two more crews; in a short time, enormous quantities of hastily cut and sawed pine and hardwood began

---

1. Lizars, Daniel. <u>A Report on the Affairs and Influence of the Canada Company</u>, submitted to the Governor-General, 1840.

2. Ibid. It should be noted that the "Report" of 1840 was due to the complaints of a group of dissatisfied settlers, whose objection to the Company's monopoly of mills was at least partly due to a desire to exploit this resource to the full themselves.

to arrive at Goderich, by raft[1]. Lizars notes that thousands of feet of this were never sold, the lumber being of such poor quality that export was impossible, and the local market being too small. From the records of the company, it appears that the two operators made something like £4,000 out of this contract in 1835, before the Canada Company could terminate its disastrous bargain.

Settlement proceeded on a planned basis in the tract; the first surveys laid out main roads, with ranges of 100 acre lots on either side, and the company tried to sell these first, with, apparently, the object of making the roads safer for travellers and of having a readily available supply of labour for improving the roads. Much work on them was done by settlers, who were in arrears on payments for their land[2]. One writer states that an attempt was made to run these main roads parallel to the line of the chief water-courses, while the side roads were (very roughly) parallel to the line of the tributaries. There are traces of this attempt in parts of the Huron Tract, but it was not carried out at all rigidly. The main roads were run straight at some distance from the rivers, only occasionally conforming to the broader curves of the stream. This is a system more likely to appeal to conservationists than the rigid northsouth gridiron. However, since some of the first roads were not at right angles to each other, there were a large number of irregularly shaped lots. The area of these was often wrongly computed and this led to disputes and litigation with the company and other settlers. Thus the half-hearted attempt to substitute an intelligent layout for the conventional one (so convenient

---

1. The rafts were towed by oxen, probably following the beaches. W.H. Smith; Canada, Past, Present and Future, 1851.
2. Shirreff, Patrick. A Tour through North America (1835) p. 175.

to surveyors and land-office clerks) became a source of complaint and added to the hostility, which soon began to grow up between many settlers and the Canada Company.

The settlers had at least the satisfaction, such as it was, of being able to pursue their disputes with the company in the ordinary courts. When Lizars states in his "Report" of 1840 that there was more litigation in Huron Township after ten years than in the whole history of some earlier townships, he ignores the fact that when those early townships were settled it was almost impossible to obtain redress in disputes concerning Crown grants other than by petition to the Land Boards, from whose dilatory and sometimes arbitrary decisions there was no appeal, save by a fresh petition to the Governor-in-Council.

The Canada Company was primarily a commercial concern and as such was actuated chiefly by considerations of profit. When "good business" (usually on a short-time basis) could be combined with wise planning for the future of the district, the company planned as wisely as could be expected. But when the interests of the shareholders clashed with those of the settlers, the shareholders were apt to get the best of it. Company officers did not, as their more vocal opponents seemed to think, spend their nights plotting the further oppression of the inhabitants; but on the other hand, they may properly be charged with short-sightedness, some bad management and, in a very few instances, incompetence.

It was under these conditions that British emigrants began to move into most of the Ausable Watershed in 1830. The first comers, as has been indicated, took up land along the London Road, in Hay and Usborne Townships; they were, however, forced to exchange their lots for others in 1835, when a Glebe Reserve was set up in the area they had chosen. In 1831, the settlement of Williams East began with the arrival of a Highland Scot, Peter McIntyre. He was

joined by many of his compatriots during the next few years, and half the township was taken up by 1840. A sawmill was built by Donald McIntosh near the present site of the village of Nairn, in the winter of 1833-4 [1], but the first groups had to take their grain at first to the Goderich Mill, and after 1834 to McConnell's at the present site of Exeter. A grist mill was added to McIntosh's Mill in 1836-37 [2]. McConnell's and McIntosh's Mills at first ground only whole wheat flour, so white flour had to be got from Goderich for several years more.

An unusual feature of settlement in Biddulph was "Wilberforce", a colony of fugitive negro slaves near the present site of Lucan. Several accounts of it appear in the various county histories published in the nineteenth century, but none of these will stand comparison with either the records of the Canada Company or the testimony of contemporary travellers. Both Patrick Shirreff and the Rev. J. Proudfoot of London visited the colony in 1833, when it was well established. Shirreff says of it that "the houses, barns, fences and general appearances of this settlement are certainly mean enough, but I considered it in most respects equal, and in some respects superior, to settlements of whites in the Huron Tract of the same standing of three years". The settlement was on a tract of 800 acres between Lucan and the "Little Ausable", on both sides of the London Road (Highway No. 4) sold to J.C. Brown and Stephen Dutton on September 20,

---

1. The History of Middlesex County, 1889, much of which is based on hearsay, and the uncertain memories of descendants of settlers, says the mill was built by Donald McIntosh in 1831, but the Parkhill Gazette Review for April 11, 1901, gives the correct year, 1833, and adds that McIntosh was "an agent for the Canada Company". The assessment rolls for the London District show no mill until 1834, probably the year the mill began working. In this year also, a D. McIntosh bought 400 acres of land in Williams West. The land around the mill site was not taken up until 1837.

2. Assessment returns, London District, 1837.

1830[1]; Frederick Stover, called in one of the county histories, "a Connecticut Quaker", the active organizer of the colony, is listed as a part owner, his name being pencilled in below those of Brown and Dutton at a later date, which unfortunately is not given[2]. The property was paid for and a deed issued in 1838. Quakers apparently continued to manage the colony and operate a school until the early 1840's, after which the negroes made their own way. Only a few of them were still on their holdings forty years later.

With 1832, settlement began in other townships; McGillivray and Stephen, as well as the portion of Tuckersmith within the watershed received their first inhabitants. By this time, letters from settlers had gone back to England, Ireland and Scotland; and the Canada Company was not slow to publicize these. As a result, some fifty new settlers arrived in the watershed in 1832-3, notably James Willis, whose clearing on the London Road is noted by county histories as the only habitation for twenty miles[3]. The Huron County Atlas of 1879 recounts that Willis, after building his cabin and installing his wife in it, set out for London on foot to buy a hoe, with one shilling, all the money he had left. Hoes were not obtainable at that price, so he had to walk back to his "location" and plant his first crop of potatoes with an axe. Early in 1833, an inn was established under contract with the Canada Company, by a son of William McCon-

---

1. Records of Contracts, Canada Company. Dominion Archives.

2. The simple notation "later" is prefixed to Stover's name.

3. Willis is said to have arrived in "the early winter of 1832". He bought his lot in April 1833. McConnell's tavern was open in February 1833. Canada Company Records show twenty-four other sales along the portion of the London Road within the watershed, all in 1833, so that Willis' loneliness cannot have endured for long. He may have arrived a few weeks before the others, a period which grew, apparently, with each retelling. His contract with the Canada Company shows his property as Lot 15, Concession I, Usborne.

nell, a London Township tavern keeper. McConnell built a saw and grist mill near where the London Road crosses the river, in 1834. William McConnell's land probably came to him, at least in part, in payment for his contract to open the southern half of the London Road, as he also received lots in Tuckersmith, Biddulph and McGillivray[1].

It was also in 1833 that the first permanent occupant ventured into the western wilderness of Bosanquet; one sale had been made there the year before, but this was shortly abandoned. Bosanquet generally remained little settled until the early 1850's; it was too far from roads, stores and other settlers. Only eighteen sales had been made there by the end of 1840, and of these, eleven were either abandoned or resold within a few years. A village did grow up on the tract around Brewster's Mill, but this disappeared later[2]. Williams West has a similar history of late settlement.

The surveys of the Huron Tract were completed in 1839, with the exception of about 8,000 acres along the lower Ausable in McGillivray, Stephen and Bosanquet, which were too swampy to lay out. By that date, nearly 60,000 acres had been taken up. Some settlers, notably the Hodgins and Balkwills in Biddulph and Stephen, and the Scottish group in Williams East, were expanding their farms, or buying new lots for sons, indicating that there was already a prosperous group of farmers in the area.

---

1. The McConnells (William and Alexander) chose their locations near crossroads where they thought villages would grow up. William and Alexander owned the sites of "Francistown" and Clandeboye and a block of 400 acres near "Rodgerville" south of Hensall. George and D. McConnell also had lots on the site of Exeter.

2. The mill's nearest neighbours in 1850 were eight miles away on one side and twelve on the other. Smith, W.H., Canada, Past, Present and Future; 1851.

3. Roads and Improvements:-

With more than £48,000 to be spent by the Canada Company on improvements, it was expected that the development of the Huron Tract would be rapid. However, it appears that much of this sum was at least unwisely expended. A large proportion of the total sum was used up on the harbour at Goderich, and on bridges, which required replacement after only a few years of use[1]. The company rarely, if ever, called for tenders for work; the fact that it preferred to make payment largely in land made contractors demand higher prices. The figure already mentioned of £265 per mile as the cost of the Goderich-Wilmot and Goderich-London Roads is taken from the company's own accounts; and Lizars states that one man had submitted a tender of £40 per mile for the Wilmot Road, which was not accepted because he wanted cash and the company wished to pay in land. Allowing for considerable optimism in the estimate of £40[2], there still remains a large gap between this tender and the price actually paid, a gap which can only be attributed to poor engineering and bad management.

In the case of the London Road, the contract was let in two sections, on estimates approved by the Executive Council in February 1830, to William McConnell and James Ingersoll. The work was completed in December 1832, and greatly exceeded the estimates in cost. Thomas Mercer Jones, the company's commissioner, explained the excess satisfactorily, however, to the Executive Council and the company was credited with £3,215 15s. against its improvement account[3]. In less

---

1. The frequent floods account for the high mortality of early bridges.

2. Contractors for the early roads in Upper Canada usually underestimated the cost and failed to fulfil their contracts. Payment in land was an accepted practice.

3. Minutes of Executive Council of Upper Canada, June 22nd, 1833, and November 21st, 1833.

TRANSPORTATION
AND
PUBLIC UTILITIES

SCALE: MILES

1 0 1 2 3 4 5

than two years, it was necessary to take up the corduroy so expensively installed, since it was already in very bad condition, and "turnpike" the road. This consisted of removing the stumps and throwing the earth up from the sides of the road to the centre, thus forming a crown. For this work, a large group of settlers was employed during 1834, and the company was credited with a further £3,268 1s. 6d.

A contemporary account, by Patrick Shirreff, gives an idea of the state of the roads:

"The roads formed by the Canada Company in the Huron Tract have been styled good by the Backwoodsman, and so puffed off in every British newspaper, that Englishmen may be apt to imagine they are Macadamized. They are simply straight lines formed by felling trees, the branches and trunks of which have been burned, or formed into corduroy, and the stumps, from two to three feet in height, left standing. I have already alluded to the extent of corduroy, a description of roads which most travellers speak of with horror, and, without meaning to praise it, I must say it was by far the best and smoothest portion of the Goderich roads. The roots projecting from the stumps ----- kept the wheels and axles of our waggon moving up and down with the regularity of the beam of a steam engine, and were alike annoying to us, and fatiguing to the horses, and more especially when travelling between Van Egmont's tavern (between Clinton and Seaforth) and London".

This was written in August 1833, just seven months after the first "opening" of the road had been completed and before the "turnpiking". There is no doubt that a Canadian would have been much less horrified than was the English farmer, since the description would fit almost any newly "opened" road in Upper Canada, and usually the interval between "opening" and "turnpiking" was much longer. However, it was reasonably felt that the large sums expended, might have produced better results.

Smaller roads were opened by settlers, but these do not appear in the Canada Company's accounts. In 1839, a main road was constructed along the boundary between Hay and Stephen Townships, including a bridge across the Ausable at a cost of £505. Further repairs were necessary on the London Road from 1840 to 1842, and at about this time

it was partly planked[1]. In the 1840's the Lake Road (the present Blue Water Highway) was opened, the work being finished in 1849. Roads were constructed in McGillivray and Bosanquet in the 1850's and the Thames Road through Usborne was opened in 1851.

In the meantime, the Canada Company had completed its payments to the Crown, and received patents for the whole of the Huron Tract (unsurveyed portions excepted). There remained in 1847 some £4,000 to be expended on improvements; the company posted a bond of £6,000, which was to revert to it on satisfactory evidence that the full sum of £48,383 8s. 4d. had been spent, and wound up its contract with the Crown[2]. By this time, a District of Huron had been set up, and the Canada Company was in the position of an ordinary taxpayer -- or rather an extraordinary one, since its influence was very great. After 1850, under the municipal organization of the United Counties of Huron, Perth and Bruce, the remaining sum of £1,179 was gradually exhausted, and in 1856 appears the first entry noting the company's "proportion of the cost" of a bridge over the Ausable in Bosanquet. In the same year, the county issued debentures for road improvements, and the London Road was gravelled under normal municipal arrangements[3]. By 1859, 150 miles of road in Huron County had been gravelled[4].

In the southern portion of the watershed, out-

---

1. Sir J. Alexander, L'Acadie, or Seven Years Explorations in British America. Vol. I, p.140. This again was ten years before some of the main roads in York County were planked or gravelled.

2. Final agreement between the Crown and the Canada Company, 1847.

3. Huron "Signal", Goderich, several issues, 1856, and Journals and Transactions of the Board of Agriculture of Upper Canada 1856.

4. Journals and Transactions of the Board of Agriculture of Upper Canada. Vol. V, p.111.

side the control of the Canada Company, the principal highway was the Egremount Road, built during the early days of settlement. Rosewell Mount's account for this and other roads, already referred to, indicates that the Government undertook its construction, leaving the settlers to open the side roads as part of their settlement duties, although the military grants required some road work even from settlers on the main road.

In 1841, a grant of £15,000 was allotted for planking the road from an Imperial Government loan. However, the road was not kept up, and the Public Works annual report for 1847 states that "nothing has been done on this road since its completion, and for want of mere ordinary repairs, it is becoming, in many places, impassable[1]". Smith in his _Canada, Past, Present and Future_, notes that it was in very poor condition in 1851. This state of affairs continued for some time; by 1860, however, six miles of the portion of the road passing through Adelaide Township had been gravelled[2], and further gravelling took place during the next ten years.

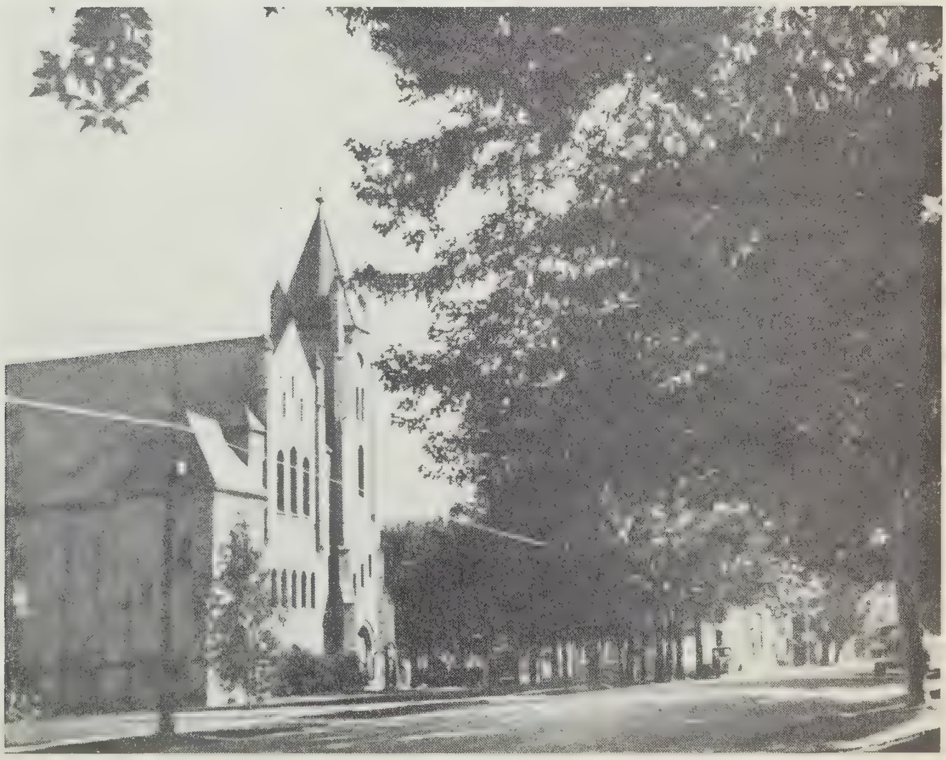
Roads in London and Lobo were constructed under similar conditions, with the exception of the "Proof Line Road" (present Highway No. 4) in London. This seems to have been a better than average road from its opening in the early 1820's, probably because of the Talbot methods. In 1849, Freeman Talbot proposed and carried through the formation of a joint stock company under a new act just passed by the Assembly; its shareholders were the residents along the road, and its capital (£32,000) was entirely devoted to gravelling and improving the high road, which was for several years the best in the region. Although it did not cross the

---

1. _Journals of the Legislative Assembly_, 1847.
2. _Journals and Transactions of the Board of Agriculture of Upper Canada_, 1860, p.125.

St. Anne's Church of England, Adelaide. Built 1866. First church 1836. Congregation organized by 1835. The first church in the Ausable Watershed.

Presbyterian church at Carlisle, Williams East Township.



Crediton 1947. Looking east towards the crossroads.

Ausable Watershed, it was the principal approach to it, and this improvement increased the tendency of settlers in the southern portion of the watershed to buy and sell in London rather than in Goderich.

Other improvements financed by the Canada Company included churches and schools; considerable sums, by the standards of the times, were expended on these, including nearly £600 in 1849. In one or two cases, where settlers were impatient, a church or school appears to have been built by the farmers, after which they sought repayment from the company.

Churches were scarce in the watershed in the early days, and schools were not very plentiful. An Anglican church had formed part of the plan for Adelaide Village and the Rev. Benjamin Cronyn was appointed in 1832. He was, however, forced to break his journey from Ireland at London, Ontario, and was persuaded by the inhabitants to remain and start a church there. His place at Adelaide was later taken by the Rev. Dominick Blake, who had been appointed to the rectory of Cairngorm, south of Strathroy. By 1835, services were being held in a schoolhouse at or near Adelaide[1]. A church was built and a glebe reserved in 1836. Settlers . Williams and Biddulph, as well as those in Adelaide, Warwick and Lobo attended services in Adelaide Village, which still had only this one church in 1851. A glebe was set aside in 1835 on the London Road just north of the Hay-Stephen line, but there was no church in Hay Township until after 1855. It was well into the forties before other denominations got buildings under way, after settlement had greatly increased. The Presbyterian Highlanders of Williams East had at first to range far afield. The nearest Presbyterian church was in

---

1. <u>Report of the Select Committee on Grievances</u>, 1835.

Embro, and it was there that they went on some Sundays at least, about forty miles by road[1].

In 1846, the only resident clergymen in the Ausable Watershed seem to have been the Anglican rector of Adelaide and the Free Church Presbyterian minister in Williams East. The rest of the area, until about 1850, depended on the services of clergymen who lived outside the watershed, although some churches were built in the late forties[2].

Schools were much more numerous than churches, and as in the case of the Adelaide school, they were often used for church services as well. The date 1838 is given on a monument as that of the building of the first schoolhouse in Adelaide Township, but from the reference already quoted it seems that there was a schoolhouse near Adelaide Village in 1835. Similarly, the first schoolhouse built in Stephen (Lot 15, Concession I) and used for services for some years must have been in existence before 1848[3], for two schools are listed for "Hay and Stephen" in 1846, and a school in Stephen received a Government Grant of £9 7s. 11d. in 1847. The first school in Usborne is said to have been at "Francistown" (North Exeter) and this may be one of the two just mentioned, as a school in "Hay and Usborne" received a grant in 1847. Two common schools are listed in McGillivray in 1846 and three in Williams and these also received grants in the following year. The total number of "common" schools in the area at this time, seems to have been about ten or twelve. A teacher's salary averaged about £33 a year, which probably had the purchasing power of at least $350 at the present time.

---

1. MacKay, W.C., Pioneer Life In Zorra. Services at Embro were held in Gaelic at first.

2. The first church in Usborne was built by Presbyterians (Free Church) at Rodgerville, but does not seem to have had a resident minister for some years.

3. The date given in the Historical Atlas of Huron County, 1878.

LAND SOLD
OR GRANTED
1820–29
1830–39
1840–54
1855–76
UNSETTLED
BY 1876
SCALE OF MILES
LAKE HURON
STANLEY
TUCKER-
SMITH
HIBBERT
HAY
USBORNE
BLANSHARD
BIDDULPH
STEPHEN
McGILLIVRAY
BOSANQUET
WILLIAMS W.
WILLIAMS E.
WARWICK
ADELAIDE
AUSABLE
RIVER
THE CUT

Teachers were usually men, and often boarded themselves. Some, at least, were married and had families.

4. The Period of Growth 1840-1875:-

Reference to the settlement map will give an idea of the proportion of land taken up in the watershed at the beginning of 1840. Actually only a small part of this was under cultivation. There are no documents to confirm the dates of commencement of farming operations on each lot, but Smith notes that in 1846 only seven to twelve per cent of the land taken up was cleared and cultivated. In McGillivray, for instance, the Upper Canada Gazetteer lists 11,382 acres as sold or leased, but only 808 acres under cultivation (including pasture). This is the lowest figure quoted, but the other townships were not much more settled. The picture, then, that a traveller would see would be long stretches of woodland, broken here and there by a ten or twelve acre clearing, around a log house. Grain was often threshed on open floors at first and hay stored in stacks. Where barns existed they were often frame structures built later than the houses and superficially of better appearance[1]. Mills were not plentiful; three grist mills and eight or nine sawmills served the needs of the settlers in 1846, and some of these suffered from lack of water in the summer. A traveller who passed along the London Road in 1841 visited mills "twenty miles from London" (apparently a rough estimate of the distance to Clandeboye) but stated that "at this season of general drought the supply was not sufficient for the constant working of the machinery[2]". Sir J. Alexander notes

---

1. A Statement of the Satisfactory Results of Emigration, etc., Canada Company Pamphlet, 1846 ed. Here a traveller notes the barns are "better built than the houses". Small log stables were often built before the barns. The first frame barn in Williams East dated from 1837.

2. Ibid.

that the little Ausable was "teetotal dry" at the same point in August 1843[1].

Taverns and inns were becoming more plentiful; "by the year 1842 the inns between Goderich and London numbered forty-two, and so inadequate was even this accommodation that at night eight or ten travellers would be lying on the floor of one of these places, with bits of wood for pillows[2]". The number of inns did not make up for their quality; travellers constantly refer to the poorly built walls, gaping doors and windows, and general discomfort of the inns.

The 1840's brought a new influx of settlers, but of a different class. The Canada Company was not satisfied with the instalment system of sales; although deeds were not issued until all payments had been made, there were legal difficulties in connection with settlers in arrears. A man who had made two or three payments and then fallen behind could very reasonably present a case for maintaining his equity in the property, even though his contract with the company stated that the land should revert to it on repayment of the instalments. The fact that all the improvements he had made enhanced the value of the land added to the complications, and increased the hostility of settlers towards the company. Aside from these considerations, settlement was proceeding fairly slowly, in part because of the scarcity of immigrants with capital.

The Canada Company, therefore, determined upon a system of leases whereby poor immigrants could lease

---

1. Alexander, Sir J., L'Acadie. The little Ausable was in exactly the same state at the same point in September 1947.

2. Lizars, R. & K., In the Days of the Canada Company, p.164. There were eight or ten inns in the watershed in 1846, and possibly four or five stores. Most of these inns and stores were on the London Road.

land for ten years, with the option of converting the lease to a sale at any time by paying the full price of the lot. In this way, the company's continuing title to the land would be incontestable, and settlement would be speeded up because of the attractiveness of the system to men without much capital. Modifications of the scheme set up a graduated series of rent payments[1], which included instalments on the purchase of the land; if a settler fell behind, instalments already paid in were to be applied against current rent. In 1839, the first leases were signed and the tempo of settlement altered and quickened.

Unfortunately for the company, the new policy aroused more opposition than ever. Its more educated opponents got busy with pencil and paper, and calculated that the rent payments plus instalments were equivalent to rates of interest of about 8½ per cent on the purchase price[2]. To this, the company replied that the value of land was constantly rising, and that the instalments were calculated roughly to ensure that the company should not lose by leasing land rather than holding it for sale. The grievances of the settlers with regard to improvements continued, since the leases stated explicitly that the lessee forfeited the land with all improvements if he fell twenty days in arrears.

It was under this system that the bulk of the land in the Ausable Watershed was settled, between 1840 and 1854; much of the remaining land was taken up in the late

---

1. A typical series of instalments, for a 12-year lease, from 1842, makes a total price, including rent, of £110.5.0 for 100 acres, or 22s. per acre. Cash sales at the time averages 13s. per acre.

2. Aliquis, Observations on the History and Recent Proceedings of the Canada Company, 1845. Similar calculations, with similar results, are often made by the purchasers of motor cars, etc. under modern instalment plans. The company's argument that they lost by leasing land was specious, however, for it was their duty to settle the country not to speculate in land.

fifties. This growth meant that little of the produce of the area was exported until the peak of settlement was nearly reached. The new arrivals provided a ready market for the produce of older farms. In 1841, a traveller states that "but little surplus grain is at present available for exportation. All that the farmer can produce is brought up by the incoming settlers [1]". Lumbering seems to have been on the same basis until after 1860. Although few documents exist, Lizars' testimony indicates that the company found it extremely difficult to sell lumber outside the tract. The Transactions of the Agricultural Board for 1858 also mention that little lumber was produced in Huron County. After 1860, some lumber began to be exported, notably barrel staves from Stephen Township, and a small quantity of cherrywood, but it was not till a later period that the sawmills of the area reached their greatest activity. Much of the timber felled in clearing was burned and part of it made into potash, which seems to have been produced in about the usual quantity. The total value of exports from Goderich in 1850 was only £5,203, and even allowing for an equal amount going out via London, it seems that the district cannot have been important as an exporting area.

The good times of the 1850's came to the Ausable Watershed as they did to the rest of Ontario. Farming became extremely profitable, and there was a rush to take up land. Most of the remaining lots in Adelaide, Lobo and London Townships were taken up, and the Huron Tract experienced a great increase in population. By 1854, the price of land was about 19s. 6d. per acre, and hundreds of ten-year leases were being converted to sales annually. In the years from 1852 to 1856, the Canada Company took in more than the total

---

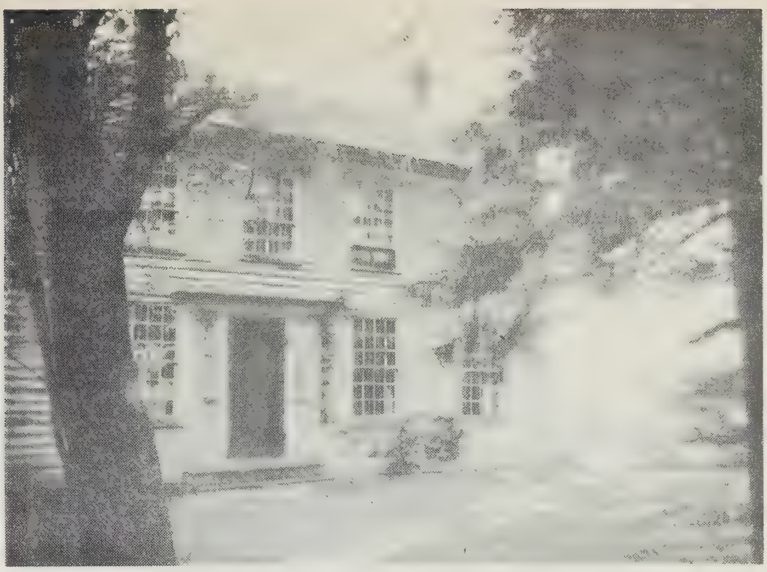
1. <u>A Statement of the Satisfactory Results</u> &c.

price they had originally paid for the whole Huron Tract. It is a curious fact that, just during these years, Company opponents charged that land was being withheld from sale to the detriment of the Huron District, because the company had come to prefer the lease system. Many settlers did apparently go into the Crown Lands north of the Huron Tract, which were opened for sale in 1855 because they preferred an outright purchase, and many leased farms did revert to the company for arrears, but it seems that settlement in the Huron Tract was not in such a languishing condition as has frequently been assumed. These conversions of leases continued, although in diminishing volume, well into the depression years after 1857[1].

The boom in farmland had other effects. The 1850's were the years of railroad expansion in Ontario, and with the easy money then available, several schemes were put forward to bring railways to the Huron District. Steel had been laid as far as London by 1853, and promoters were anxious to extend lines into the rapidly developing western districts; the railways themselves in turn encouraged development to ensure their own profits. A line from Sarnia through Strathroy to Komoka was chartered in 1852 to serve the southern townships of the watershed, and gradually pushed its way along its surveyed route. The Buffalo and Goderich Line was completed in 1858. Both these lines were outside the Ausable Watershed, to the north and south, but provided arteries for it. The Grand Trunk Line from Guelph to Sarnia, finished in 1859, ran straight across the watershed, bringing with it the usual skyrocketing of land values along the right of way, the shifts of population centres and the laying out of new towns, which occurred all through Canada with the coming of a railway. The communication system of the watershed

---

1. Canada Company Record of Contracts, Dominion Archives.



House of about 1851 near Carlisle. Moved to present site from the village where it was used as a tavern.

House at Widder. Built before 1858.

Old house in Clandeboye. This was Glendennan's Hotel in 1878.

A buff brick farm house of the 1870's. The band of ornamental brick work under the eaves is characteristic of houses of this date along the London Road.

was not completed until 1873-76, when the London, Huron and Bruce Railway was constructed from London to Clinton.

Population doubled in the decade 1850-60, and there was a further rise in the sixties. As the rate of growth slowed, produce became available for export; small industries grew up to serve the local market, and later to ship their products outside the watershed. The timber trade, small in the early sixties, began to increase in importance. At the same time, the log houses of the farmers were being replaced by frame structures, and even by brick in some instances. In 1840, there were only seven frame houses in the portion of the Huron Tract within the Ausable Watershed; by 1870, nearly every farm of ten years' standing could boast of one. In the villages brick buildings were not uncommon by 1860 and by 1878 many of the older farm-houses and barns were being replaced by "handsome and commodious white brick and tasteful frame buildings" in an increasingly elaborate style[1].

Improved living conditions became general; cookstoves replaced fire-places in the kitchens; sewing machines, pumps and hundreds of other manufactured articles began to be widely used. Fraternal orders established branches in the area, and the schoolhouses, which were becoming a common sight every four or five miles, were used for their meetings, as well as for other social gatherings. Inns and taverns were now widely distributed and some of the hotels in the larger centres rated high by the standards of the time for both style and comfort. Churches representing most denominations could now be found in the watershed. By the middle sixties, the original frame churches were beginning to be replaced by brick buildings, in many cases. As has always been

---

1. Historical Atlas of Middlesex: 1878. The quotation refers to Williams East but applied fairly well to most parts of the area. The "tastefulness" is less apparent to modern eyes than in 1878.

the case in Ontario, the churches were probably the most important centres of social activity.

The area was becoming "civilized" and was losing the rawness of backwoods' life. Life moved slowly by modern standards, but it was far from being colourless or dull. The district, like most of early Ontario, was sober and law-abiding, compared to some parts of the frontier in the United States, but there were occasional outbreaks; such as the burning of Brewster's Mill and the feuds along the London Road. The inns and taverns did not cater only to travellers, and during much of this period, the region was full of construction gangs working on the railways and the "Cut". It was at this time that Lucan was known as "the wildest town in Ontario".

In 1875, most of the district was a prosperous farming area, already well settled, and which had emerged from the pioneer stage. Industries producing for an outside market were developing in several of the villages. The shift from subsistence farming and grain-growing for export to dairying and stock-raising had already begun, but was not yet causing any appreciable decline in rural population, while it was increasing the importance of the various villages. Settlement was still going on in some areas and the lumber business was active and increasing. There seemed every prospect of further development in the future.

5. Municipal Organization and the Growth of Towns:-

The organization of municipalities and local government in the Ausable Watershed followed the settlement at about the same interval as in most areas settled after 1815 in Southern Ontario. During the first days of settlement, there was no means of registering deeds locally in the Huron Tract. Thomas Mercer Jones, the Canada Company Commissioner at Goderich, proposed the formation of a county to be added to the London District, in 1833. This was put into

effect, and thenceforth legal business was conducted at London, while the Canada Company did much of the local administration. In 1842, a District of Huron was formed, with a council sitting at Goderich, and such local officials as had existed -- a constable, a coroner and one or two clerks -- were transferred to the new body, and a sheriff appointed.

The Western District (Essex, Kent and Lambton) was formed in the same year. A representative of Warwick was present, as well as S. Ward, who had settled in Bosanquet in 1837, and who had been chosen to attend by his few neighbours. However, in 1843, the District Clerk was "instructed to inform Mr. Ward that as Bosanquet was not a township, there could be no township clerk [1]", and Bosanquet remained unrepresented until it organized as a township in 1847. In 1849, the Western District became the United Counties of Essex, Kent and Lambton, and finally in 1853, Lambton County became independent.

A similar evolution took place in Huron, where the United Counties of Huron, Perth and Bruce were formed in 1850; Perth acquired its own county buildings and a separate existence in 1853, but Huron and Bruce remained united until 1866.

Adelaide and Lobo Townships were organized in the thirties; the rest of the townships in the watershed between 1840 and 1850. The story is told in County Histories that when McGillivray organized a Township Council in 1850, only six freeholders could be found from which to choose a council of five. Canada Company Records, however, show sixteen sales of land before 1840, which were fully paid up by 1850, and more sales were made later, so that the often recounted tale must be regarded as apocryphal.

---

1. Lambton County Records.

The inhabitants of McGillivray and Biddulph found the trip to Goderich inconveniently long, and their contact with county officials otherwise too remote. They therefore petitioned for annexation to Middlesex County; this was granted, and on January 1st, 1863, the two townships were shifted from Huron to Middlesex. Williams was divided into Williams East and West in 1860.

There are no cities or large towns in the watershed. Parkhill is the only incorporated town, and except Exeter, none of the incorporated villages had a population of more than 1,000 in 1947. Exeter is also the only village, which has shown any appreciable recent growth until within the last ten years. Parkhill was never a town of any size, and is now smaller than many villages in other parts of the province.

(a) Adelaide:-

Adelaide, with a population of about 120 in 1846, was the only village in the watershed until after 1851. The grandiose plans of its founders have been a source of amusement to local historians, but until the building of the railway through Strathroy and Watford, Adelaide grew steadily, in spite of the lack of good water-power. This lack was overcome in the fifties by the building of a steam grist mill, and in 1857 the village was a place of some considerable trade[1]. The building of the Grand Trunk Line to Sarnia in 1858 drew off most of the remaining traffic on the Egremount Road and by 1871, although the grist mill was still running, Adelaide had lost population and business to its more fortunate neighbours.

(b) Nairn:-

McIntosh's Mills formed the natural centre for

---

1. The population was about 200, but there were five general stores and three inns. There seems to have been only one store in 1851.

the Highland settlement in Williams East, and a thriving village grew up there in the 1840's. Before 1845, a post-office for Williams Township had been opened with McIntosh as postmaster and a minister of the Free Church (Presbyterian) established nearby. In 1857 "Nairn" was the terminus of the "Lobo and Williams Gravelled Road" and had a population of about 200. There was a regular stage to Lobo, and the village had two inns and four general stores, a circulating library and a Presbyterian church (Church of Scotland). The industries included two brick-yards, as well as the saw and flour mill, a second sawmill, a woollen factory and a tannery. The post-office was now called Nairn instead of Williams. By this time, new communities, somewhat better situated, were growing up and Nairn had lost ground by 1871, though the population was about the same and the mills were still running. The flour mill, however, was doing custom work.

(c) Carlisle:-

Carlisle or Falkirk Post Office, in the eastern angle of the same township, was the first rival of Nairn. The good water privileges on "Siddall's Creek" made Carlisle, during its heyday, the most important milling centre in the watershed. Carlisle developed quickly. There was a sawmill there in 1846. Shipley's Mills were built in 1850, and in 1857 the village had probably a larger population[1] than Nairn and as many stores. There were three inns[2] in the village, but no church as yet. There was already a steam sawmill and the waters of the creek turned the wheels of no less than three grist mills, as many sawmills and a carding and

---

1. Lovell gives the hardly credible figure of 1,000. His list of businesses, however, indicates a possible population of about 400 or more, a large village for the time and place.

2. The "Victoria Hotel", built in 1855, is still standing. It is described as "large and commodious" ten years later.

MUNICIPALITIES

SCALE: MILES

1 0 1 2 3 4 5

fulling mill. Several of these were above or below the village-site, some at the hamlet of Siddallsville in Lobo, which consisted chiefly of three inns, and one was higher still, in London Township towards Denfield. No such concentration of mills was to be found in any other part of the watershed except at Exeter. There were five house builders in the village, an indication, like the brick-yards at Nairn, of the prosperous state of the surrounding country. Carlisle's prosperity was to be short-lived. In a year or so, the railway was drawing away trade, and Carlisle was a much less busy place in the late sixties with fewer businesses and a smaller population. It was still an important local centre, however. An Agricultural Show (The Union Show) was held twice a year. A frame church had been built "open to all denominations" and this a few years later became a Presbyterian church after a second church had been built by the Wesleyans. By 1875, Carlisle was a "quiet village" with "many wealthy retired farmers" living in it. Several of the mills were still running and a cheese factory had been opened, but Ailsa Craig was now the business centre for the neighbourhood. There is now little left of Carlisle but one church, a few good early houses, widely scattered, and the broken mill dams along the "River Lyon". Nairn, more compact and still on a main road, makes a somewhat better showing, but its most striking feature is the large cemetery, beautifully situated and kept up.

(d) Exeter:-

The lots which include the site of Exeter were all granted before 1840. James Willis purchased Lot 15, Concession I in Usborne in April 1844, and not long after four members of the McConnell family obtained grants between that point and the Thames Road. McConnell's tavern was already open in February 1833, but was still in an unfinished state. The lots on either side of the road through which the river

runs, seem to have been unoccupied and uncleared for years after McConnell had set up his mills. Probably this was due to the fact that they were often under water for long periods. The first beginnings of a village were at "Hay Post Office", where the post-office for Hay Township was established. This was expected to be the chief town of the neighbourhood and did develop into a sizeable village. However, by the early fifties, there was a hamlet of sorts at the cross-roads a mile and a quarter south of Hay, where Isaac Carling had opened a store and tannery in 1847. This village evidently flourished during the next ten or twelve years. There are several good brick buildings in this part of Exeter, which date from just before and just after 1860. A hamlet had also grown up near the mills, which was called "Francistown". A village plot had evidently been laid out in 1853, for in 1857 Exeter is referred to as "a thriving village of four years' growth[1]". The growth had been rapid for by then Exeter had at least four or five hundred inhabitants and Francistown and Hay about 200. George McConnell's saw and grist mill was still running, and there were possibly three other grist mills and two sawmills on the river. Besides these there were a steam grist mill and a steam sawmill in Exeter and a foundry in Francistown. The town was equipped to supply the wants of travellers on the high road, who needed smiths and waggon makers, saddlers and harness makers, shoe-makers and inns, in the same way that modern traffic requires service stations, hot-dog stands and repair shops. The necessities and luxuries of the neighbouring farmers were catered to by a long list of tradesmen and storekeepers, while

---

1. Lovell's Canada Directory 1857-8. Lovell estimates 600 population but he is evidently including part of Francistown with Exeter, and he lists some of the mill owners, storekeepers, etc., under both places. The population may have been larger or the mills somewhat fewer.

bricklayers, carpenters and joiners, an architect-builder and a sash-door-and-blind maker were taking advantage of the building boom.

It is evident that Exeter was already the chief market town of the district, a position it has maintained ever since. The building of the Grand Trunk Line through Lucan increased the importance of Exeter, since the stage was the only connection between the railways at Clinton and at Lucan. In 1871, Exeter and North Exeter (Francistown) contained nearly 1,000 people and were practically one village, though the upper part of the present business section appears to have been built mostly after 1875[1]. The two villages were incorporated in 1873 as the village of Exeter, the population then being well over 1,000. The building of the railway was eagerly expected at that time. When it was completed in 1876 the station was placed midway between the two cross-roads and streets were laid out on the west between the line and the high road. The railway brought further prosperity to Exeter, which is now the most populous permanent urban settlement in the watershed, having 1,980 inhabitants in 1947, and more than 2,000 in 1948.

(e) Clandeboye:-

In the forties, a centre of some importance had grown up near the fork in the London Road, where one branch turned eastwards to meet the "Proof Line Road", while another led straight south through London Township to the Egremount Road (No. 7). In 1846, this included three inns and two stores, but was spread out over more than a mile from the inn on Lot I "Proof Line Road" in Biddulph to the

---

1. The present buildings are built of the yellowish brick commonly used in this region after 1860, and in the style of 1875-1895, with interesting local characteristics which indicate a good grasp of the capabilities of brick work on the part of the designers.

inn and store on Lot 19, Concession I of McGillivray[1]. It is probably because of the straggling character of this settlement that it was considered not "deserving of the name" of village in 1851[2]. A post-office for McGillivray Township had been opened on Lot 13, Concession I of that township be-before 1845, and this was soon moved south to "Flannigan's Corners", as the village was called at first. It was also known as "Irish Town" or "Ireland" the last being the official name of the village. The post-office, however, continued to be McGillivray for many years. "Ireland" was at that date a more important settlement than Exeter, and it remained the local centre until after the opening of the Grand Trunk Railway, but was then soon overshadowed by Lucan. In 1857, the village contained about 300 people, several inns and stores, a church and usual complement of craftsmen. There was only one mill, but the Division Court sat in the village and gave extra employment to several of the inhabitants. By 1871, the population had shrunk somewhat and the volume of business had declined noticeably. The fact that Clandeboye had a station and siding on the London, Huron and Bruce Railway kept the village from disappearing altogether, but it now shows few signs of its early importance.

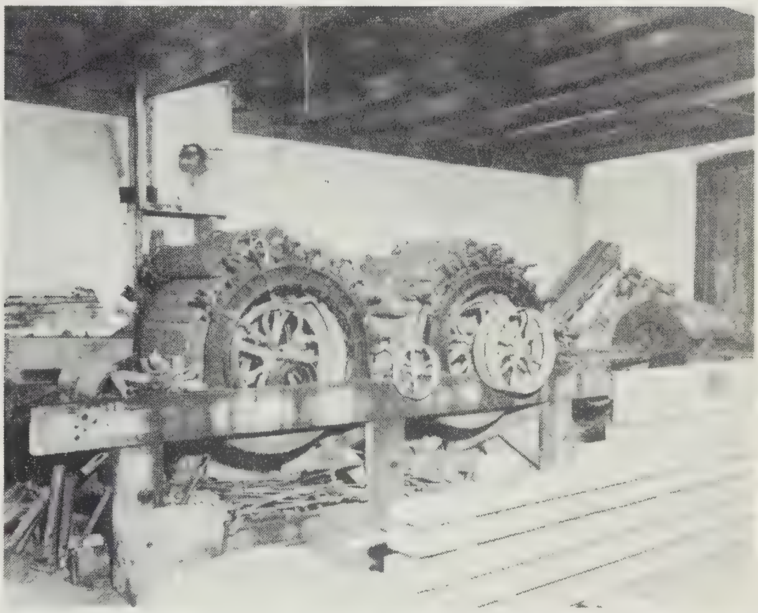
Of the earliest settlements on the Ausable Watershed, which may be said to have started before 1840, only Exeter has been able to maintain its prosperity until today. The increased settlement of the early fifties pro-

---

1. Map of the Huron District; 1846. The other inn and store were on Lot 20, Concession I, McGillivray and Lot 24, Concession I, Biddulph, respectively. The post-office, tavern and sawmill are all shown south of the "Corners" on the Canada Company Map of 1849, but this probably was an error.

2. W.H. Smith in 1851 says: "There is no village, or at least nothing deserving the name, on the London and Goderich Road". It was his policy, however, to minimize the progress of settlement in the Huron Tract in order to disparage the Canada Company.

Grist mill near Denfield, Lobo Township. The last of the mills on the "River Lyon".



Carding machine in Bell's Mill west of Hensall in Hay Township. An older machine from this mill is now in the Ford "museum village" in Dearborn, Michigan.

Bell's Carding Mill (disused) on Black Creek, west of Hensall. Built about 1860. The saw mill is now in a separate building to the right. There was a sawmill here in 1846.

Bartlett's Grist Mill, Williams West Township. This mill replaced a much older building. Power is furnished by a small stream falling into the ravine of the Ausable. The equipment is still in good condition. There was a sawmill here in 1846.

duced a crop of villages in all parts of the watershed. In 1846, there were only three post-offices in the watershed, all "township" post-offices. In 1851, the number had increased to five, but only Adelaide was a "village" office. In 1857, the list had increased to sixteen or seventeen, only four of which were still named for townships. The development of post-offices is a good indication of the spread of settlement and the opening of roads. Of the villages, which centred round the new post-offices opened before 1856 only Arkona (Bosanquet Post Office) was able to maintain its growth after the re-adjustment which followed the building of the railways.

(f) Arkona:-

A post-office was opened for Bosanquet Township about 1848 at the junction of the road to Port Franks and the line of the south boundary of Williams Township. The village grew rapidly in the fifties and by 1857 had a population of more than 300. There was a grist mill in or near the village and others not far away[1], a tannery and possibly a saw and shingle mill. A good deal of building was evidently going on in the village and the district. In the next few years, Arkona developed to some extent into an industrial village. Situated at an important road junction, equally distant from three important railway stations, and in an area which was being heavily lumbered, the railways increased its prosperity and importance. A large foundry was opened in 1858, a woollen factory in 1860 and flax dressing plant in 1871. The steam flour mill had then a capacity of 50 barrels a day, and there were three other flour mills, a paint mill and sawmills not far from the village. Arkona was still a fairly busy place for another generation, although there was

---

1. There was a grist mill at Rock Glen and a sawmill on Lot 17, Concession VII, Williams West, by 1846.

little growth of population, but the exhaustion of the timber and the depopulation of Williams West and the other townships have affected Arkona to some extent and it is now seventh among the villages of the watershed.

The other pre-railway villages have practically disappeared. Sylvan began with a sawmill, in 1851; a steam mill was built the next year and before long Sylvan was the centre for a number of wood working mills. There was also a brick-yard south of the village, but the proximity of Parkhill and Thedford prevented any growth of population. The mills were closing down or being moved by the beginning of this century and Sylvan is now little more than the name of a cross-roads.

(g) Widder (Pinehill Post Office):-

A similar situation existed in Bosanquet, where a considerable market town and centre of population had grown up by the early fifties at the village of Widder. Widder was laid out by the Canada Company, one of the few examples of the Company's "town building" in the watershed[1]. It shared the local lumbering trade with Sylvan and Arkona. When the Grand Trunk Line by-passed Widder in 1858 on its way to Sarnia, the railway company built a station about a mile and a half from the village. Around this grew up a town which attracted merchants and mills from the older site to new locations, so that Widder declined rapidly in population as "Widder Station" grew into Thedford.

There were never any large villages in McGillivray west of the 2nd Concession; the mills were scattered and no one of the small settlements, which grew up near them became especially important before the growth of the railway

---

1. Exeter is said to have been "laid out by the Canada Company"; but there is no evidence of this and, except for the river lots, all the site had been sold as farms before there was any subdivision.

villages. West McGillivray Post Office was opened in the 1850's, but the village even with the neighbouring hamlet of Lieury, remained a small place. Brinsley was a cross-roads village near a grist mill and Moray owed its importance to three nearby sawmills.

(h) Crediton:-

Crediton in Stephen was already a village by 1860. It had a grist mill from the beginning and before long a brick-yard was opened. The village did not grow to any extent, however, until after another brick-yard, a sawmill and a flax mill had been opened in the early seventies. Crediton was now the administrative centre for the township and a good-sized village. It was, however, to become larger and more important in the next period.

(i) Port Franks:-

Port Franks is an example of an artificially developed town, which did not grow out of the needs of the region, and therefore remained very small for a long time. The "port" was apparently named for a member of the Canada Company Board, who was a godson of Mr. Bosanquet. Tradition has it that the town was laid out by a freak of William Dunlop[1], and its original site was apparently intended to be at the bend in the river where Grand Bend now stands. It is shown there on Canada Company maps of the 1840's. The company's maps induced at least one emigrant to make a two-day trek from Sarnia in search of the non-existent port. On his

---

1. If Dunlop was responsible for the name, it must have been given before 1841 while the peppery doctor was still on good terms with the Board. In an election pamphlet of 1841 Dunlop refers contemptuously to Franks as "a little Cockney" and seems to imply that his relation to Bosanquet was not purely religious. If a "Captain Franks" later sailed Lake Huron, this was as much of a coincidence as the presence of a storekeeper named "Peter Burrows" at Peterborough. The towns were both named for officials, not local characters. On a large map of the Huron District, published in 1846, the land north of Grand Bend is marked "Reserved for Port Franks". See R. and K.M. Lizars: "In the Days of the Canada Company", 1896, p.265.

arrival at Brewster's, near the locality marked on the map, he inquired for Port Franks, to be met with the reply "Port Franks? Port Humbug, there's no Port Franks here"! The luckless Englishman's insistence that it was on the map was greeted with mocking laughter. According to his own account, Brewster had at that time no neighbours for miles on either side[1].

However, when the actual survey was made, lots were laid out on the present site. The first sales were made in 1851, to four would-be town dwellers, who remained the only inhabitants for many years. Eight lots had been disposed of by 1854, but some of these reverted to the company. In the company's records of 1876, twenty-four lots are shown as sold or leased.

Since a harbour was of vital importance to the area, it may seem strange that Port Franks did not develop more rapidly. Though the sand bar at the mouth of the river limited it to vessels of less than six feet draught; this could have been improved by dredging, and there was from 15 to 16 feet of water at the site of the village. The difficulty was the inaccessibility of the site. The river shoaled so much between the village and Grand Bend that it was impassable even for boats and the marshes and sand hills cut off Port Franks from the country to the north and east. Willson[2] had realized these difficulties in 1819 and had recommended that any settlement be made near the portage where he evidently thought that a canal could be cut to the river which had then a good depth for about fifteen miles above the Bend. There is no evidence that Dunlop had seen Willson's Report, but he may have been influenced by the same considerations in select-

---

1. Smith, W.H.: Canada Past, Present and Future, 1851.
2. Report on the River aux Sables, 1819, Canadian Bureau of Archives.

ing the original site of "Port Franks". Time was to prove this the better site, but it was many years before the channel was cut at the Bend and by then the lake traffic was no longer so important.

A colony of French Canadians from Quebec settled in the neighbourhood of Port Franks as early as 1846, but they appear to have been mostly squatters. The French were evidently not reckoned in the estimates of population for in 1857 it is given as about thirty. There were then two taverns and a sawmill (probably steam) and no less than three Episcopal Methodist ministers. Mail reached the post-office twice a week. Thirteen years later the activities of the "port" had increased. The inhabitants included a ship-builder, a captain, a mate, a shipowner and four fishermen. The lay population had more than doubled, but the clerical had declined 100 per cent. One hotel and the sawmill were still open.

(j) Grand Bend:-

Though Port Franks was finally laid out elsewhere, a post village did grow up at the southwest corner of Stephen Township after 1851. The post-office was called Brewster and served the hamlet of Summersville (at or near Brewster's Mill) and whatever settlement there was near the portage at Grand Bend.

Brewster's Mill had been burned in the early sixties, but there was a shingle factory at "Summersville" in 1871, and there was a grist mill in the neighbourhood, probably belonging to John Dalziel, a lumber merchant with sawmills at Thedford and Port Franks. There may also have been a steam sawmill near Grand Bend[1]. Dalziel is said to have

---

1. Lovell - Canada Directory - 1871; Mackintosh - Directory of Lambton County, 1871-2. Lovell places "Summersville" eleven miles from "Widder Station" (Thedford) with its post-office at Brewster. He lists "Geo. Summers - shingle factory" and John Johnston - miller" under "Summersville". John Dalziel appears under Port Franks as "Lumber Merchant" and Jas. Dalziel as mill foreman. Mackintosh gives "John Dalziel - sawmill" under Thedford.

[illegible]

Carlisle from the south, 1947. Remains of Shipley's mill in the right foreground. Victoria Hotel to left and church in the distance on extreme left.

Town hall at Parkhill on the site of the first grist mill.

The "back street" at Nairn, 1947.

Bruce seemed to the inhabitants to threaten their prosperity and they voted $7,000 as a bonus to the company to induce it to put the line through Lucan. Actually, however, the line was run through Lucan Junction about 2½ miles west of Lucan, and since there has never been any development there it seems probable that the decline in population which occurred in Lucan a few years later was due more to general conditions than to the loss of the road traffic. The village continued to be an important market town in spite of the gradual shrinkage of the number of its inhabitants.

(l) Ailsa Craig:-

The site of Ailsa Craig was settled before 1840 and "Williams" post-office was moved to the neighbourhood before 1856. However, the village was not laid out until 1858. A store and hotel were built in the next two years. Steam grist mills and other small industries soon followed. The "Middlesex Agricultural Society" began to hold its Exhibitions there about 1870. The area was already "one of the finest grazing districts in Ontario" and monthly cattle fairs were held in the village in the early 1870's. Besides cattle, considerable quantities of flour and grain, lumber and staves were being exported. The village, however, soon felt the competition of Parkhill, and never was more than a thriving market and centre for the surrounding country.

(m) Parkhill:-

Parkhill was not even settled until about 1860. A post-office (called "Swainsby" and then "Westwood") was opened after the railway was built and a store and hotel put up soon after. A village was laid out, but until 1864 there were only five or six houses. In that year the inhabitants subscribed $1,078 bonus to induce "Messrs. Harrison & Harrison" to build a grist mill on the site of the present town hall. A second mill, a tannery and a church (Roman Catholic) soon followed and a few years later the village (now called

Parkhill after a Scottish town) was a thriving place of about 900 inhabitants. Several other large brick-yards were in operation by 1875. The town had been incorporated in 1872 and was now the largest place in the district. There seemed every prospect of Parkhill becoming a large and important town. It was considered "the principal station between St. Mary's and Sarnia" and "no other village in Middlesex seemed to have progressed so fast". Large quantities of grain, squared timber, lumber, staves and tanbark were being exported in 1870 and a few years later bricks, furniture, woollen goods and other manufactured products were also being shipped out. This prosperity was unstable, but in 1875 Parkhill appeared to have a brilliant future.

(n) Thedford:-

Thedford's prosperity depended largely on lumbering and wood working until well into the present century. It was the business and shipping centre for the surrounding sawmills, as well as for plants actually in the village. The movement from Widder to "Widder Station" was gradual at first, so the new village grew more slowly than other railway villages. Since its incorporation in the seventies, Thedford has remained at much the same size, the decline of lumbering having been offset by the development of intensive farming and of the tourist trade in the country to the west and north.

6. The Watershed Since 1875:-

The period of the late seventies was probably the time when the Ausable region was in its most prosperous state. The peak of rural population came about 1880, but by then various factors were then already slowing up the development of the area. These were not limited to the Ausable region, but were general to almost all parts of Ontario which had been opened up before 1840. The change to mixed farming or specialized stock-breeding was already well under way and

farm machinery was becoming more common, but there had not yet been much reduction in number of hands employed in farming. The emigration to the west, which was to drain off much of the Ontario farm population in the next forty years, was only beginning. The region was well settled, well cultivated and productive. It was dotted with small but busy villages, two or three of which seemed almost certain to grow into fair-sized towns. The surplus "country produce", manufactured goods and lumber were finding a good market outside the watershed.

The peak of development came a little later in Hay and Stephen Townships, where vacant land was still being settled. The area available for settlement had been increased considerably by drainage operations in the early seventies. The land along the Ausable from Grand Bend for ten miles south, and for a considerable distance on either side, was subject to annual flooding from the earliest times, and remained marshy throughout the year. When Brewster and Smart built their dam south of Grand Bend in 1832, the water had been backed up still farther, and drainage ditches dug by settlers on the edges of the marsh proper proved to be almost useless. This state of affairs continued for some time. The Canada Company tried to sue Brewster's and obtain an order compelling the dismantling of the dam, but their case was not granted a hearing in England, on the grounds that they had condoned the operations for nineteen years[1]. Finally the dam was dynamited and the mill burned by a group of angry farmers from McGillivray and Stephen Townships, in the early 1860's. This, however, did not materially improve the drainage of the land, and a new mill had been built before 1868 without protest from the farmers.

---

1. A judgment in the same sense had been given by the Chancellor of Ontario, which was sustained on appeal.

It was apparent that the Canada Company could not hope to dispose of land so wet; the idea was, therefore, evolved of draining the area by constructing a diversion of the river, which would also cut across the southern end of Lake Burwell, emptying it as well. Specifications were published and tenders called for in 1872; the work was completed by 1876. Lake Burwell was drained and Lake George reduced to its present size, acquiring the name of Smith Lake somewhere in the process, but the latter's former bed was still marshy. And the "drowned lands" of Stephen and McGillivray, as they were called by local residents, were only partially drained.

One thing was apparent, however. The land thus reclaimed was of surprising richness. Black silt loam to unheard-of depths was left behind by the receding water. These first reclaimed areas were the beginning of the now-famous "celery beds", from which vegetables and berries go to all parts of Ontario and neighbouring United States. The newly surveyed lots sold readily where they were not too wet, and settlement went forward another step.

In the other townships, however, the changes in rural economy were having their effect. There was probably already some loss of population before 1880. The planning of the London, Huron and Bruce Railway was, however, responsible for the founding of new villages. Centralia was laid out in 1870, on a site west of the highway, obviously chosen in expectation of the railway, and Hensall was planned in 1877, around a station on a newly-finished line. Hensall grew quickly and replaced Rodgerville, which has practically disappeared. Its chief industry was the Petty Pork Packing establishment, an indication of the more diversified farming which was becoming general in the seventies. Centralia also grew quickly after 1876, and the "post villages" of Devon and Adare on the London Road were gradually superseded by the

new village and have also disappeared. Crediton, however, was able to maintain itself and expand, although not on any railway, and the proximity of this flourishing place prevented Centralia from growing as large as might have been expected.

The 1880's saw the end of the market for Ontario wheat and the beginning of the movement away from the countryside. All the townships of the Ausable region declined in population between 1881 and 1891 [1]. The late seventies and early eighties were years of depression: the effect on the farming community was felt only for a short time since new markets for various specialized farm products soon opened up. More and more land was being brought under cultivation, wheat growing had increased again after the bad crop years around 1870 and other crops were being grown in larger quantities. The first enthusiasm for cheese-making and flax-growing was over, but there were still several flax mills and cheese factories operating in the watershed. Beef cattle began to be exported to England about 1878 and heavy draught horses were already being raised and exported. The market for wool was excellent during the seventies and there was some development in hog raising. Altogether, the farmers of the region were prosperous, but farming was already developing along lines which called for fewer hands and this trend was to increase in the next few years.

In the larger villages, however, the depression of the late seventies had a more direct effect. All the older villages were checked in their development, temporarily at least, and, for all but two or three, the years between 1875

---

1. The sharp drop in population figures noticeable in most townships in the 1881 census was due to the incorporation of villages in the early seventies, which were already quite large in 1871. These populations had been included in the township figures.

and 1881 marked the height of their population and importance.

Parkhill suffered most. A financial crisis developed from the failure of one of the larger firms, which involved the local banks. Finally the Exchange Bank failed in 1882 and brought down more businesses with it. The town had received a blow from which it never properly recovered. By 1885, there had been a rally, the various firms were re-organized and many of them were still running in 1909, but from 1891, at least, the town grew steadily smaller and in the early years of the present century it had become plain to the inhabitants that Parkhill's future was uncertain.

Port Franks naturally increased in importance, after the opening of the "Cut". In 1883, a salt well was sunk in the village, 1,345 feet deep. An evaporator was built and for some years lumber and salt were shipped from the "Port" in schooners. Vessels were now usually loaded from lighters outside the bar, since they had trouble in crossing it when loaded. Boat building and fishing were still carried on and for a few years Port Franks enjoyed a brief prosperity. Before long, however, the floods coming down the "Cut" undermined the banks and silted up the river. By 1890, it was too shallow for the barges and tugs and Port Franks dwindled once more to a small fishing village with a few summer visitors.

Meanwhile, Grand Bend had been growing in size, and there was talk of the village becoming incorporated, if the channel was cut to the lake[1]. When this cut was made in 1893 the "Bend" also became a fishing port, while the pier at "Fort Blake" was abandoned and Brewster became unimportant, though it retained its post-office for some time longer. More and more visitors were coming to Grand Bend in summer, and a

---

1. Exeter Times - March, 1889.

beginning had been made of the resort business, which was to grow so greatly after the first World War.

The failure of the banks must have had its effect on the other villages[1], and on part of the farming community at least. The years after 1878 were a period of prosperity for the farmers, but were followed between 1885 and 1895 by ten years of hard times. These were reflected in sharp declines in the acreage of crops and increase in the area of pasture in most of the townships. Wheat production dropped sharply after 1880 and there was a marked loss of population in all townships and most of the villages. There was a return of agricultural prosperity before the end of the century, but the drain of population from the townships has continued steadily without relation to the fluctuations of the markets for farm produce. With the improvements in farm machinery about 1890, far fewer hands were needed to render a given acreage productive and the growing shortage of labour hastened the mechanization, which in turn lessened the need for a large farm population. In the northern part of the watershed, the decline was on much the same scale as in other parts of the province, but in the southern part, particularly in Williams East and West, the depopulation has been unusually rapid and continued until 1945. These two townships had fewer inhabitants in 1948 than they had in 1848, ten to fifteen years after the first settlement. Biddulph has also fewer inhabitants than it had a century ago, but since this township was then the most populous of those drained by the watershed, the present density of population is much greater in Biddulph than in the Williams, and about equal to that in the northern townships of the area (26 to the square mile approximately). McGillivray Township, however, although more

---

1. The Exchange Bank had a branch in Exeter.

POPULATION

1 DOT REPRESENTS 100 PEOPLE

SCALE: MILES

1 0 1 2 3 4 5

populous than in 1849, has now the same density as the two Williams. The decline in rural population is very evident in many parts of these three townships. It is not unusual on some roads to pass a number of comfortable farm houses standing empty, their barns torn down to the foundations with the disused concrete silos standing beside them. The style of these houses and the growth of their wind-breaks of spruce trees indicate that they were built between forty and fifty years ago, when the countryside had recovered from the bad times around 1890 and was enjoying a period of prosperity, under a system of mixed farming. This has been replaced by extensive grazing of cattle and whole farms or groups of farms have been thrown into pasture. In other places, the buildings have completely disappeared. There is some indication that this process has reached its limits and that the depopulation of these areas has been arrested. If it had continued at the former rate for a few years longer, the townships would soon have been nearly as empty of inhabitants as when Asa Townsend first built his shanty in the wilderness of Williams West.

The villages were naturally affected by the drain of population from the areas, which they served as markets and business centres. Even Exeter, which suffered less than the others lost more than 20 per cent of its population between 1890 and 1920, but recovered somewhat in the next ten years and is now larger than at any time in its history. Hensall, the newest of the villages, reached its peak about 1900 and has not grown since, while Thedford and Arkona have remained at much the same size throughout the last fifty years. The rest of the Ausable villages declined after 1900, the tendency being hastened by the growth of large scale industry in centres outside the watershed. This led to the closing of the small local plants, while the change in agriculture ended the need for local processing plants,

such as woollen and flax mills. The exhaustion of the supplies of timber resulted in the abandonment of many saw-mills, though there are still several operating in the watershed.

However, new developments such as the truck farming in the western part of the watershed and the tourist development along the lakeshore have helped to offset the loss of other forms of business. The steady fall of population appears to have ceased and it is possible that with wise planning the area, as a whole, may be entering on a phase of prosperity.

AUSABLE WATERSHED POPULATION

TOWNSHIPS

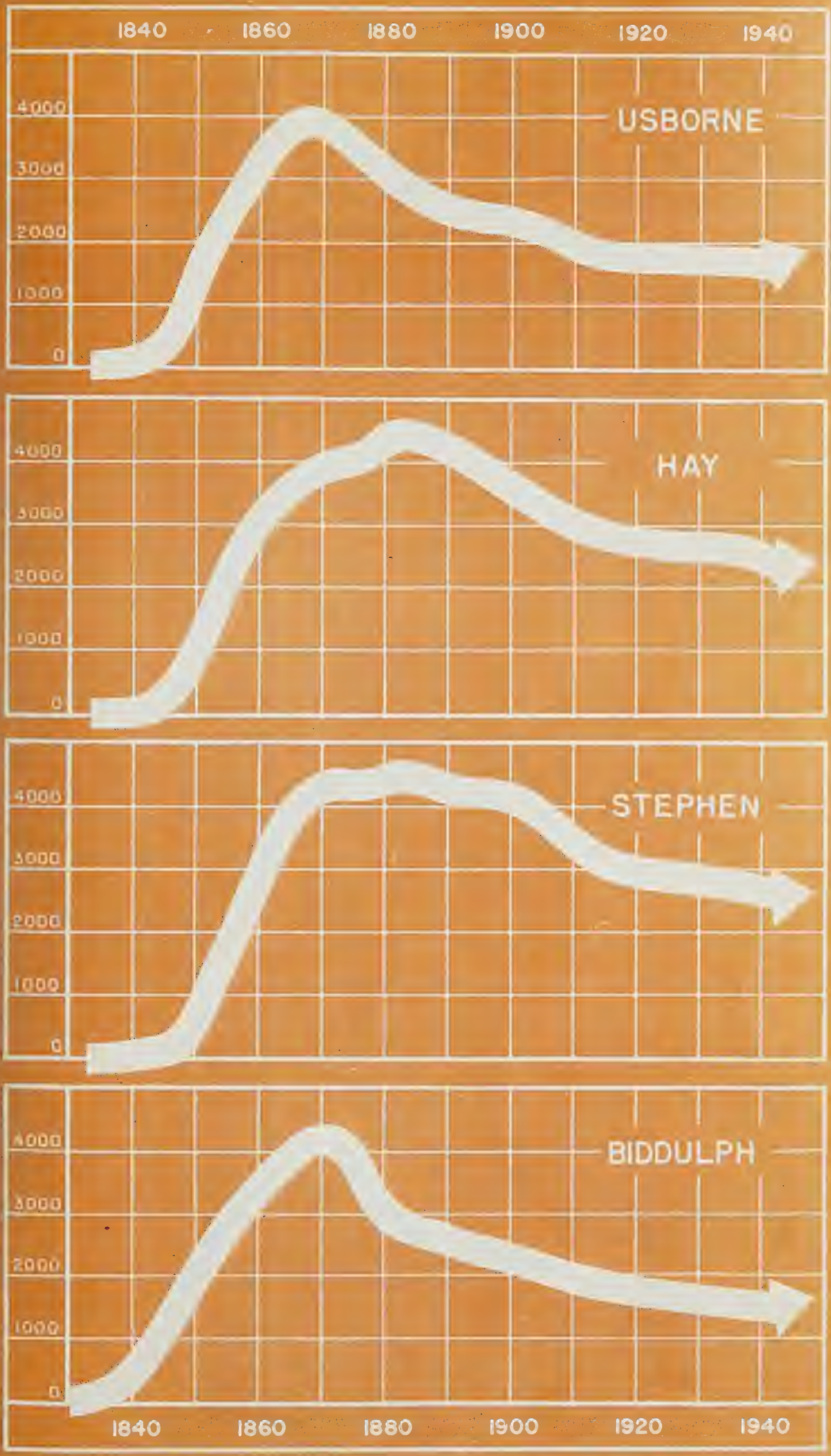
	1844	1849	1851	1861	1871	1881	1891	1901	1911	1921	1931	1941	1945	1947
Hay	113	764	985	3,054	3,897	4,421	4,244	3,627	3,014	2,724	2,689	2,544	2,131	2,109
Stephen	213	498	742	2,826	4,349	4,504	4,271	4,172	3,45[illegible]	2,895	2,847	2,676	2,991	2,386
Usborne	283	874	1,484	3,219	3,831	3,074	2,528	2,367	1,944	1,797	1,776	1,704	1,624	1,675
Bosanquet	No Ret.	571	1,093	3,097	4,425	3,360	2,866	2,862	2,491	2,332	2,200	2,246	1,858	1,856
Biddulph	1,009	1,621	2,081	3,401	4,198	2,940	2,600	2,263	1,942	1,732	1,608	1,518	1,376	1,394
McGillivray	448	1,328	1,718	3,921	4,658	4,178	3,503	3,151	2,509	2,380	2,188	2,078	1,789	1,610
Williams, East	457	908	1,245	2,475	2,853	2,195	1,794	1,587	1,227	1,104	933	900	709	742
Williams, West	400	840	1,045	2,221	3,427	2,339	1,782	1,468	1,247	1,136	1,018	951	809	724

SEPARATED TOWNS AND VILLAGES

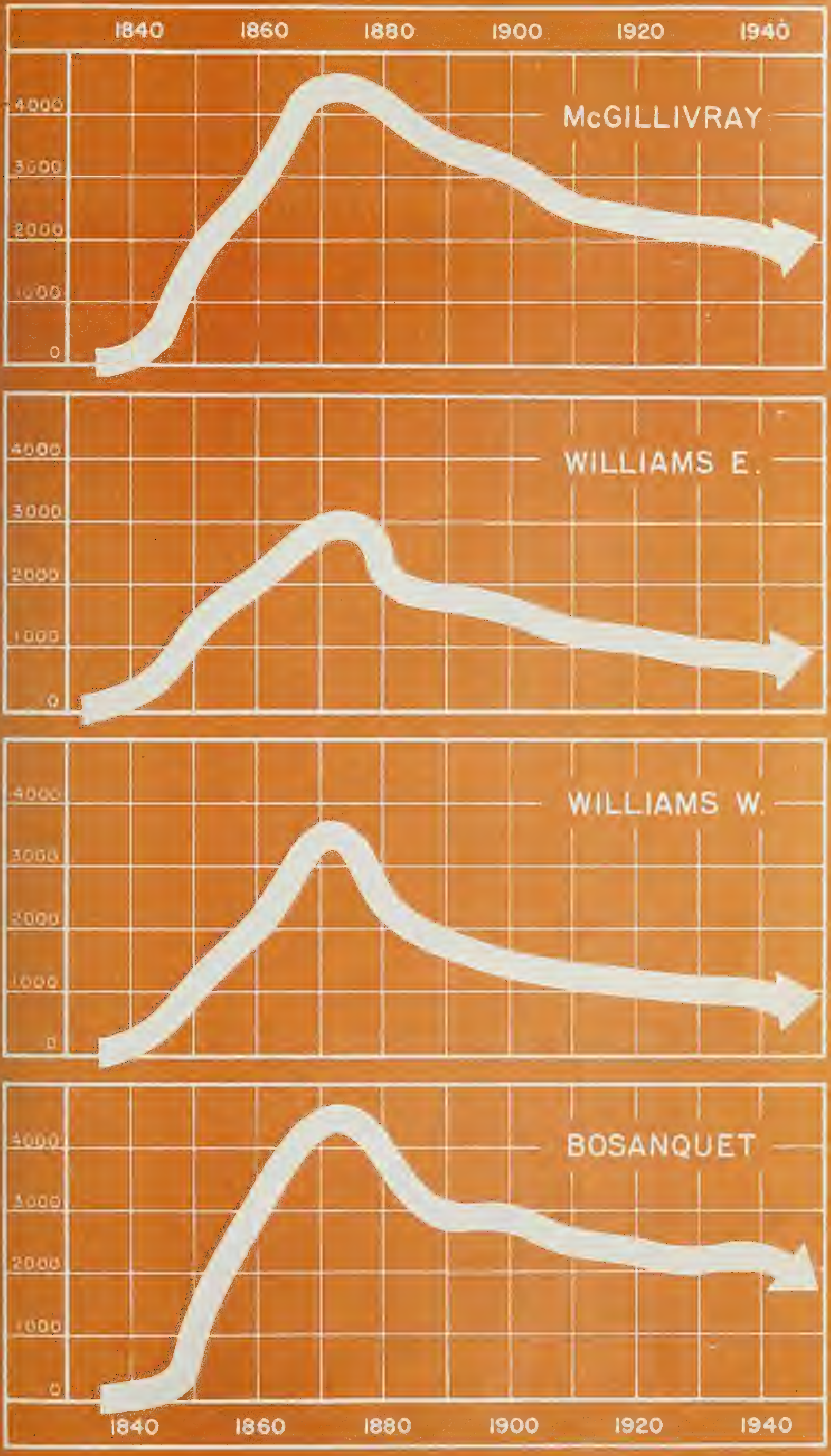
	1857	1861	1871	1881	1891	1901	1911	1921	1931	1941	1945	1947
Exeter	c.400	c.500	c.1,000	1,725	1,809	1,792	1,655	1,442	1,666	1,589		1,980
Parkhill (Town)	-	-	c.1,500	1,539	1,680	1,430	1,289	1,152	1,030	947		970
Lucan	-	c.600	c.1,000	976	920	848	709	683	606	631		715
Hensall	-	-	-	c.400	c.700	820	792	756	721	665		697
Thedford	-	No Ret.	c. 500	685	616	633	559	524	559	623		579
Ailsa Craig	-	c.200	c. 750	872	731	744	568	532	489	474		470
Arkona	c.400	c.450	c. 500	569	463	468	424	420	420	406		385

Figures marked "c." (i.e. circa = about) indicate contemporary estimates of village populations before incorporation and separation from the townships, after which reliable census figures are available.

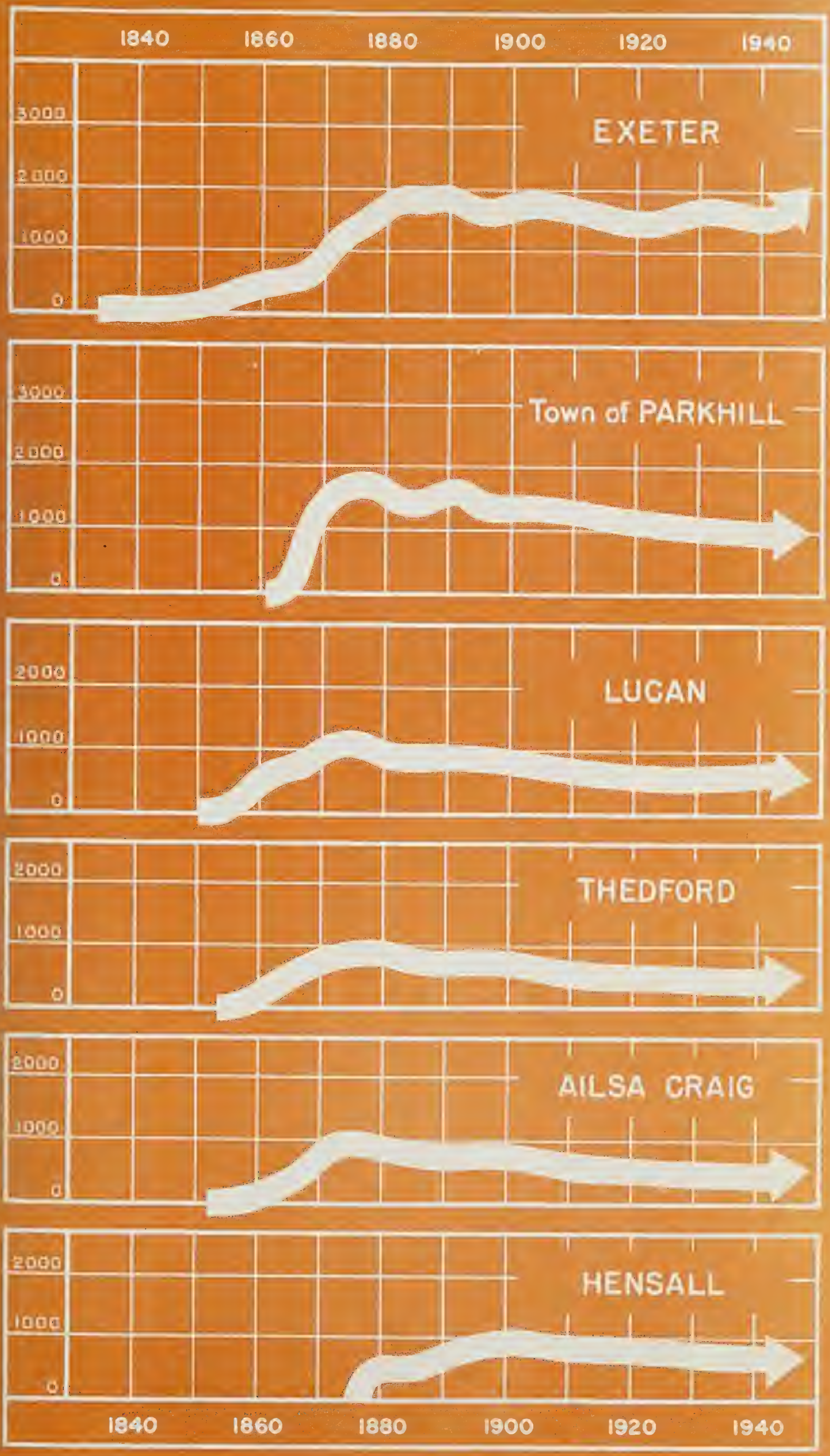
Crediton, an unincorporated village, had 500 inhabitants in 1947 (official figures), about 500 in 1875, and about 800 from 1891 to 1911.



TOWNSHIP POPULATION



TOWNSHIP POPULATION



VILLAGE POPULATION

LAND USE

SOILS AND LAND USE

CHAPTER 1

GENERAL CONSIDERATIONS

1. The Purpose of the Survey

A survey is made to determine two things, first, the kinds of soil, their extent and condition for agriculture, second, the distribution of land use. When these two sets of facts are established an estimate is made of the capabilities of the land of the watershed. From the estimated capabilities recommendations can be made for the use of the land. The findings of the field survey are presented in two maps, soils and land use. A third map is prepared to show the distribution of land use which would be most nearly in accord with the capabil ties of the soil and serve the purposes of conservation.

2. The Reconnaissance of Soils

For a part of the watershed (that part which lies in Middlesex County) a soil map was published showing the distribution of soil types and giving a brief description of them.[1] The only other information regarding soils of the area was in a publication on the physiography of the region.[2] The field maps prepared for this publication were kindly made available by the authors.

In the conservation survey the soils of the watershed were classified on the basis of their physiographic origin and their natural internal drainage. Slope, erosion and other factors affecting land use were also distinguished and mapped. This was done on what is known as a reconnaissance scale. The base map on which the observed information was plotted consisted of topographic maps of the region with a scale of one inch to the mile. All roads were traversed

---

[1] Soil Map of Middlesex County, The Ontario Soil Survey, Report No. 6.

[2] L.J. Chapman and D.F. Putnam, The Physiography of Southwestern Ontario, Scientific Agriculture, 24:3. November 1943.

by vehicles and, where necessary, traverses on foot were made between roads. Stereoscopic examination of aerial photographs assisted in identifying types of land.

3. Present Land Use

Four classes of land use were recognized and mapped, cultivated land, permanent pasture, woodlots and non-agricultural land which includes wasteland, recreational areas and urbanized land. Land use was mapped, field by field, using aerial photographs with a scale of one inch to one thousand feet. The extent and distribution of these four classes were copied onto a map with the scale of one inch to a mile so that present use could be compared with kinds of soil. By this comparison an estimation is made of the relative capabilities of the different soils.

4. Detailed Studies of Sample Areas

In addition to the reconnaissance mapping of the soils and the classification of present land use into four use classes a detailed study is made of sample areas to determine as minutely as possible the relation between crops and soil types and conditions. The sample areas are in the form of long narrow strips. The strips are selected so that they contain as nearly as possible a row of entire farms so that kinds of farms and systems of farm management can be related to the various soils. Strips are laid out so that they will contain as nearly as possible all the different kinds of land revealed in the reconnaissance survey and in something of the same proportion on the sample strip as they are found in the region as a whole.

Another kind of sample area was studied. It was one where a group of similar soils are found together and on which a specialized form of agriculture is practiced. This area is also one which has a special problem, namely flooding, which makes land use a matter of special concern. More detailed knowledge of potentialities of land use was

required for this area, commonly called the Thedford Marsh, and this was obtained by detailed mapning of all the soil conditions, crops and land use practices as well as interviewing the operators of this land.

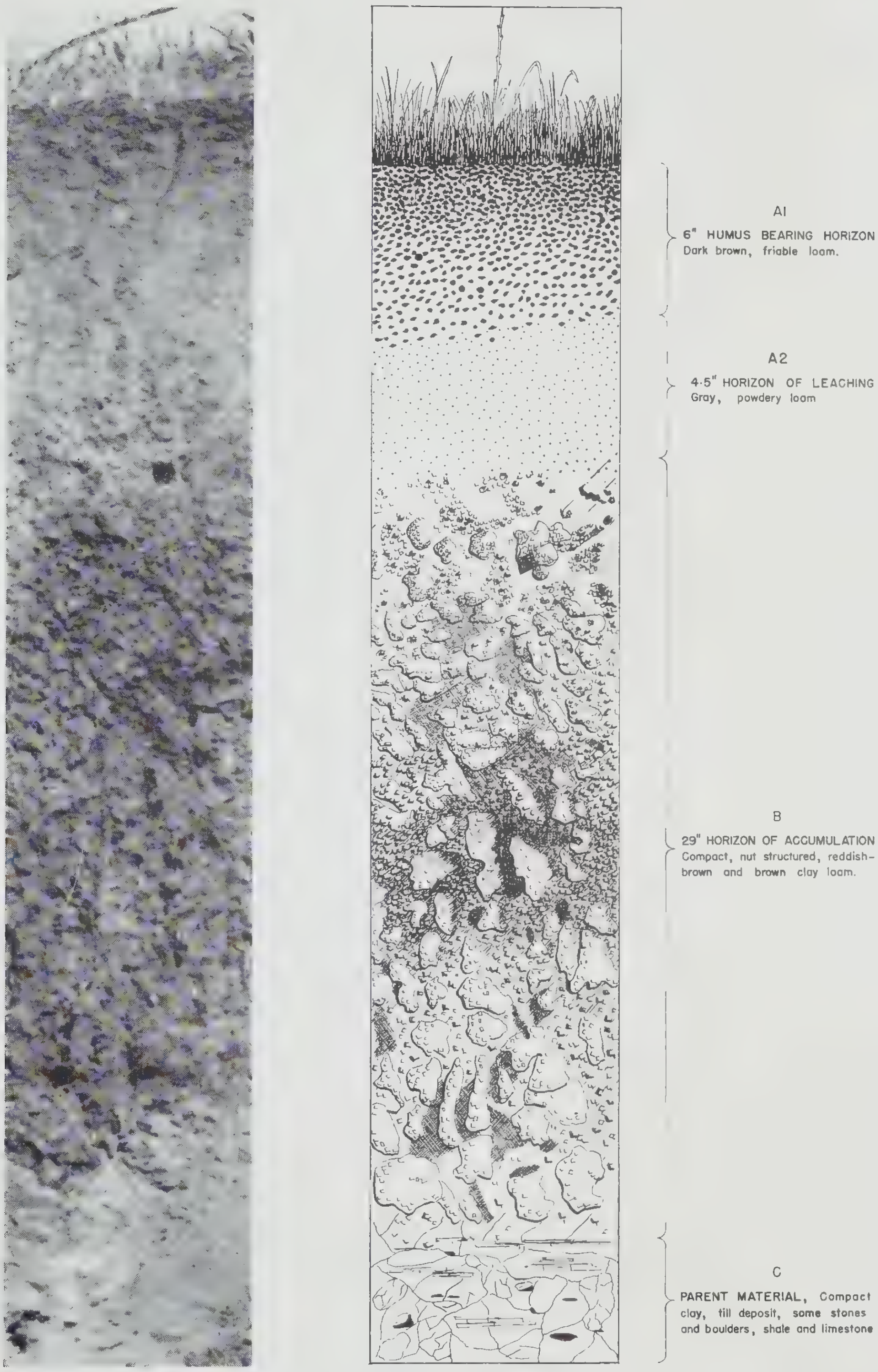
5. Definition of Soil

The soil is a living body. It is made up of unconsolidated mineral material, living microorganisms and the remains of dead plants and animals. It is formed by the interaction of living things, on and within the soil, and air and water with the mineral material. The soil provides the medium for the germination and growth of the plants that man uses. The quality of a soil is measured in terms of its capability to support the crops that man wishes to grow on it.

Soil science has shown that the strongest influences in the formation of soil are climate and vegetation. The soils of the watershed, like most of the soils of southern Ontario, have been formed under a moist, cool temperate climate and a covering of hardwood or mixed hardwood forest. The soil building process under these conditions is called 'podzolization' and the group of soils thus formed is called 'the gray-brown forest (or podzolic) soils'.

The process of podzolization in the building of a soil is as follows. Organic matter, leaves, dead wood and grass or any other vegetative product on the surface decays by microbal action. The activity of animals such as earthworms and rodents mixes the decayed organic matter (humus) with the mineral material. Decomposition of organic matter produces acids. These acids are leached downward through the soil by the excess rainfall of spring and fall. From the soil below the point where humus and mineral matter is mixed there are removed certain components, the lime and magnesia, salts of iron and the very finest particles,the colloids. This makes, in the soil, a zone of leaching.

Below the zone of leaching the downward action



SOIL PROFILE

Profile of a typical, well-developed gray-brown forest soil formed on calcareous and shaly till material in Ontario.

of the soil moisture is slowed up and some of the components are redeposited. The iron compounds accumulate and give to the soil a characteristic brown colour. The colloids accumulate and make the soil stickier. The lime is carried through the farthest. At a greater depth, anywhere from a foot to four feet depending on the nature of the ground and the climate, no weathering action takes place and the parent mineral material remains unaffected.

A cross section of a soil will reveal these differences at different levels. Such a cross section is called a 'soil profile'. The levels at which the phenomena described above are manifested are called 'soil horizons'. Combinations of the various factors affecting soil development will produce for each 'soil type' a different profile with its own particular group of horizons.

The accompanying photograph and diagrammatic sketch illustrates a typical soil profile. This example has a depth of more than three feet from the surface to the parent material. The following detailed description sets forth the profile of an idealized soil to illustrate the terms used in describing soil profiles.

Horizon	Name	Description	Common Name
A0	Humus	Partly decomposed organic debris, found only on undisturbed soils in forests.	The "A" horizons together constitute "topsoil"
A1	Melanized horizon	Surface horizon of mineral soil with greatest amount of decomposed organic matter, dark in colour, loose and friable; may be lacking or, in cultivated soils, may have been incorporated with lower horizons.	Topsoil
A2	Horizon of leaching	Light coloured, grayish powdery material, has little or no organic content. Under cultivation the A1 and A2 may be mixed together. The resulting horizon may be called "Ac" (cultivated) horizon.	Topsoil

Horizon	Name	Description	Common Name
B2	Horizon of accumulation	Dark, brownish or red brown, often structured or cloddy, due to accumulation of colloids, this horizon is stickier than either the topsoil or the parent material.	Subsoil
B3		Transitional zone between B2 and parent material. In soils with inadequate internal drainage this horizon shows mottling of brown and gray.	Subsoil
C	Parent material	Unweathered mineral material, sand, silt, clay or loam depending on mode of deposition. (If lime or magnesium carbonate is present they cannot be found free, by the acid test, in the upper horizons.)	

Variations from this idealized profile are found. The two main factors which affect profile development are parent material and soil climate which depends on drainage. Examples of some of the extreme differences are here described.

Soils developed on coarse, open material such as sand or gravel have much deeper profiles because the water is able to move more freely downward. The process of podzolization leaches lime out of the soil; if there is a high concentration of lime in the parent material this process is opposed and the profile is more shallow. Excessively drained materials allow greater aeration and the resulting oxidation reduces the amount of humus, conversely, inadequately drained soils tend to have a higher proportion of humus in the surface horizon.

The soil building processes are going on all the time. Erosion occurs on the surface, as the soil becomes exposed weathering penetrates deeper and the profile is maintained. When the soil building processes have had optimum conditions and have gone on for some time, that is, thousands of years, the soil is considered to be "mature". Soil building and erosion can be in equilibrium. When erosion occurs at a faster rate than soil is built up, as in soils exposed by cultivation, "accelerated erosion" is said to be taking

place. This is the erosion, "wash", "gullying" and "wind erosion", which is the concern of conservationists.

When a soil is inadequately drained, or there is a fluctuating water table near the surface, the soil building process, which is due mainly to the downward movement of water and the aeration of the soil, is restricted. Profiles of soils are then shallower. The characteristic brown colour of the subsoil is lacking because the iron compounds are reduced. Oxidized iron compounds are characteristically brown and reduced compounds are gray. When the water table fluctuates the subsoil is mottled gray and brown. If the water table is permanently high the subsoil is gray. In either of these cases a subsoil is formed that is very sticky due to the concentration of colloidal material. This kind of subsoil is called "glei".

6. Soil Classification

The gray-brown forest soils of Ontario can be grouped into associations, series, types and phases. Soils that are formed on the same parent material in the same land form belong to the same "association". Within this group are found "series" that are said to be "associated". A "soil series" has the same profile development wherever found. The Ontario Soil Survey assigns names to soil series when they map the counties. When a series is found that has not already been identified a name is assigned to it, usually taken from the name of the locality in which the series was first identified. In this report the series are referred to in terms of the profile development according to the internal drainage of the soils in each association. As only part of the watershed has been mapped by the Ontario Soil Survey the designation of soils throughout this report is on the basis of material and land form with natural drainage.

Within a soil series there are "soil types". These are differentiated on the basis of the textural class

of the soil so that loams, clay loams, sandy loams, clays and so forth may be separated out. This separation into types is not followed in this report, reference will only be made to them as they occur in the soil map of Middlesex County.

Within a soil type there may be differences due to some special feature of the land, not accounted for in the typing of the soil, which affect land use. This further division is accounted for in the identifying of "phases" of soil types, such as shallow, stony or steep. In this report these features are accounted for and described. Appropriate mapping symbols were used to indicate the location and extent of these features.

7. Soil Conditions

The chief problem in soil conservation is to control the erosion of the soil and the accelerated surface run-off of water. It is necessary, then, in a conservation survey to determine what land is sloping and susceptible to erosion and what land has already experienced soil erosion. The following slope classes (adapted and modified from U.S. Soil Conservation Service conservation surveys) are used in this report.

Smooth, Regular Slopes		Hummocky, Irregular Slopes	
Per Cent	Mapping Symbol	Per Cent	Mapping Symbol
0-2	--	0-5	--
2-5	A	5-15	N
5-15	B	over 15	R
over 15	E		

In topography with regular slopes land is considered level under two per cent slope, where land is hummocky no designation is given for slopes under five per cent. These distinctions are made because of the application of special land use practices designed to control erosion and run-off. Special management is prescribed for slope classes A, B, N and R.

The estimated degress of erosion that are recognized and mapped are as follows:

Estimated Degree of Erosion	Mapping Symbol
Into topsoil	1
Into subsoil	3
Into parent material	5

8. Methods of Survey

The soil is examined in three ways. All existing road cuts, excavations and holes are first examined. Where the soil is covered by sod it is opened up with a tiling spade. When frequent examinations of the soil at some depth are required an auger is used to penetrate and bring up samples of soil from a depth of three feet.

Using these methods, soil material is easily established. Use of the auger reveals the nature of the soil profile. Poorly drained soil is recognized when mottled subsoil or glei is brought up by the auger. Depth of the profile or extent of any one horizon can be estimated from a graduated scale on the shaft of the auger.

A good estimation of the depth of the parent material is made in limey soils by testing with dilute hydrochloric acid. Effervescence occurs when the acid is applied to material that contains free carbonates of lime or magnesium. Free carbonates do not remain in the weathered portion of the soil profile.

Estimation of the degree of erosion can be made by examining the soil profile down to the parent material. The appearance of the horizons may reveal the extent of erosion or the depth at which parent material is found. Previous examination of soil profiles in locations where there has been little or no cultivation, as in old woodlots or along fence lines, establishes a good average for the depth of a profile. Comparison is then made with all the samples taken. When the soil profile does not definitely reveal that erosion

has occurred any other evidence of erosion is used that proves erosion of at least class 1. Soil cut away on the downhill side of fence rows or accumulation of soil on the uphill side is good evidence of erosion. When fields are exposed by recent cultivation the establishment of rills or overdeepened drill rows with deposition of sediment downhill is taken as evidence of erosion. Sometimes crop response reveals erosion. It is common to see poor response on the shoulders of knolls and hills due to lack of moisture in eroded soil.

The establishment of boundaries between kinds of soil or soil conditions is rather harder than establishing the existence of the type or condition in the first place. Most of these features merge gradually into each other. Different conditions, however, cause marked differences in response of vegetation. The changes in vegetative growth can be seen in the aerial photograph or in the field. Boundaries are then established where such changes are most marked.

It will be apparent that observations of this kind are subject to some error. Correction of possible error is made in the following way. The land to be surveyed is set out in long strips. A pair of men are assigned to each strip. Observations on each strip are thus the average between those of two observers. When the mapping is turned in, adjacent strips are then matched. If classes and boundaries coincide then it is taken that the observations were correct. If they do not coincide, then the supervisor goes over the boundary in the field along with both parties and a compromise is reached which is believed to be the fairest descriptions of the conditions to be found. There remains some possible error. In reading the map it may be pointed out that conditions may be found in the field that are not accounted for in the map at any one spot. This may be due to a small error in the placing of the boundary or to a small area that was recognized in the field but not big enough to be mapped

on the scale of the map used. In the overall figures giving the inventory of soil it may be taken that, as the work was done by a number of observers, errors are compensated.

Present land use was identified field by field and from aerial photographs. Where the use class was uncertain it was determined, where possible, by interview with the farmer. With respect to pasture, any land that has been in sod and pastured for over five years was considered as permanent. Present use is to be understood as the obvious use to which the land was put during the year of the survey. Land classed as woodlot is that which is accounted for by the forest survey. No distinction was made between pastured and unpastured woodlot. Pastures overrun by apple, hawthorn and willow which cannot be classed as woodlot are included as pasture. Cultivated land includes all farmland which is carrying crops in rotation and may include pasture, hay aftermath crops or fallow. Non-agricultural land includes urban property, air-ports, recreational areas and a few pieces of land which are very obviously neither woodlot or pasture. These pieces of land are idle or waste land.

Throughout the following discussion of the soils and land use and on the maps that accompany the report certain mapping symbols are used to designate the various features. The meanings of the symbols are given in the legend of the maps. It will be found that the descriptions and statistical tables will convey more if read in conjunction with the maps.

CHAPTER 2

DESCRIPTION OF SOILS

1. Classification

Soils were classified on the basis of two features, first, soil material and land form and, second, profile development according to the effectiveness of internal drainage. The following are the classes of material which were recognized, the degree of drainage and the mapping symbols which were used to represent them. It will be noted that the soils, when thus grouped, correspond to the physiographic divisions given in an earlier chapter with the lake plains broken into a number of subdivisions.

Kame Moraines	- K	roughly stratified sand and gravel in hilly terrain.
Clay Moraines	- TM	heavy clay loam, some stones, rough topography.
Spillways	- W	silts , sands and gravels on floors of flat valleys.
Till Plain	- T	soils similar to moraines with gentler topography.
Beaches	- B	boulders, gravel and strips of sand, sloping.
Lake Clay Plain	- C	heavy clay loams, flat.
Lake Silt Plain	- Cl	silt loams, usually flat, some valleys.
Lake Sand Plain	- S	sandy loams, flat, some steep valleys.
Clay Veneer Till	- V	clay loams, stonefree over stony clay, flat.
Silt Veneer Till	- L	silt loams, over clay, flat.
Silt	- Sl	silt loams at various depths over till found on moraines and till plain.
Bottom Land	- BL	alluvial silt on flood plains of streams.
Muck	- M	black organic deposits in depressions or on edges of bogs.

Peat - P partly decomposed organic remains, in bogs.

Internal Drainage -

Well Drained Soil - no mapping symbol.

Imperfectly Drained Soil - d with mottled subsoil.

Poorly Drained Soil - p with gray subsoil.

2. Soils of the Kame Moraines (K)

The soils of the kame moraines are formed on deposits of sand and gravel. Many of the kames are worked as sand and gravel pits, as at Staffa, and the irregular strata of these materials are exposed. The soils are sandy and gravelly loams. There is no level land with these soils, steep slopes predominate. Because of the coarse nature of the material the internal drainage is excessive. The top soil is gray with a tendency to have inadequate organic content for good agriculture. There is a deep "B" horizon of a reddish brown colour which is heavier in texture than either the topsoil or the parent material. Because of the irregularity of the gravel strata there are great differences in internal drainage from one place to another so that the depth of the "B" horizon is variable.

The steeper slopes are often covered by woodlots. These soils are not intensively used for crops but are usually kept under sod which yields hay or pasture. Management of these soils depends on maintaining a good supply of organic matter in them. Where they are cultivated they usually are given a heavy application of barnyard manure. Springs at the bases of the hills constitute the source or headwaters of the main stream of the river. Exposure of the soil promotes accelerated run-off and the springs are likely to become dry. Protection of these soils for the sake of the river would call for reforestation while farm operators on the land might find that, under good management, the soils giving a good return in hay and pasture with occasional

use as cropland.

3. Well Drained Soils of the Clay Moraines (TM) and Till Plains (T)

The moraines and the till plains differ in form, as described in the chapter on Physiography, but are the same with respect to material. The moraine has, for the most part, rougher relief, with steep slopes and great variation in drainage, from swampy hollows to well drained slopes within a short distance. The till plain is gently undulating with slightly less elevation than the moraine.

The material of both these forms a clay loam in which are found some stones and boulders. The parent material is hard and compact and the soil shares this feature. In Middlesex County, for which a soil map is published, the well drained series on the moraines and till plains is identified as the "Huron" soil series with both clay loam and silt loam types. Huron clay loam is described on the soil map as "brown clay loam over reddish brown and then gray stony clay loam". A photograph of a profile of well drained soil on the till plain appears among the illustrations to this chapter. From top to bottom (to the left of the spade in the photograph) the following horizons are apparent:

A1 - about six inches of dark brown loam (dark gray in photograph)

A2 - six to eight inches of light gray loam (light gray in photograph)

B - ten to fourteen inches of brown clay loam (dark gray in photograph)

C - gray stony clay.

The topsoil can be deeper than that shown in the picture. The "B" horizon is a heavy, compact soil with a well defined "nut" structure when dry or in good tilth. The whole profile does not achieve the depth of that of the typical soil illustrated in the previous chapter.

Hardwood trees originally covered these soils but they are now mostly cleared and used for mixed farming with pasture, hay and a variety of crops. Roots, and such cash crops as beans, are also grown to some extent but the soil on slopes is exposed to erosion when intertilled crops are used. Though pasture is usually considered beneficial to soil in building up humus, overgrazing can deplete these soils in the same way as overcropping. Management of these soils in the past has also tended to make them hard packed and difficult to work. The most obvious symptom of depletion and deterioration of these soils is the heavy growth of wild carrot on most of the pastures. The rehabilitation of these soils will require an intensive programme of experimenting in tillage methods and soil improvement by improved pasture. The prevalence of beef production on much of the land covered by these soils points the way to future development. The great difference between the best production and the average production on these soils is significant.

4. Imperfectly Drained Soils of the Moraines and Till Plains (TMd and Td)

These soils are identified in Middlesex County as members of the Perth series. The material on which the soils are formed is essentially the same as the well drained soils on the same land forms. Due to the heavy nature of the material and its high proportion of clay they have a tendency to be inadequately drained even in the best locations. Where the surface relief precludes adequate surface drainage the soil is unable to dispose of surplus water and a poorly drained soil results. A further condition contributes to poor drainage in the soil. In the upland, interior regions of the watershed there is a permanently high water table which fluctuates near the surface.

Inadequacy in drainage is recognized by standing water in spring, poor crop response or the growth of

water loving plants. It can be recognized in the soil itself under any conditions by the nature of the subsoil. The subsoil of an imperfectly drained soil is a mottled gray and brown instead of the typical brown colour of well drained soils. Underneath the mottled horizon there is a gray horizon. Poor drainage in soil restricts the entry of air so that there is less decomposition of humus. The topsoil therefore has a thicker horizon of black soil and a thinner leached horizon. The following profile description is typical:

A1 - eight to ten inches of dark, black loam.

A2 - three or four inches of gray loam.

B - eight to ten inches of mottled gray and brown subsoil.

G - four or five inches of gray, sticky glei.

C - parent material of gray, stony clay.

5. Poorly Drained Soils of the Till Plain and Moraine (Tp and TMp)

Poorly drained soils formed on calcareous till or clay deposits in post-glacial lakes is commonly classed in the Brookston series. This kind of soil is found in low lying pockets within both the moraines and the till plain where there is no external surface drainage. Little of this was mapped on the survey as the individual areas are small. In undulating country there occur many isolated patches of poorly drained soil within areas of well drained soil. Some of the land which was mapped as imperfectly drained soil includes some of the poorly drained types.

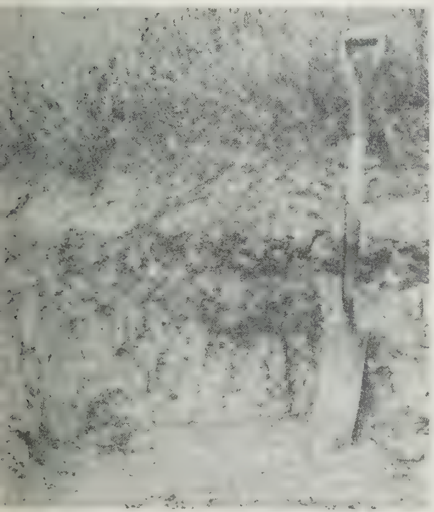
The poorly drained till and moraine soils consist of as much as a foot of black topsoil lying over a foot or so of mottled and blue-gray glei. Before the area was cleared of bush these soils carried silver maple and white elm rather than the maple-beech types of the well drained soils. Sometimes the clearing of the land was sufficient to drain them and they were brought under cultivation. Much of

A soil profile is exposed in this open ditch near Exeter. The pale coloured band is the leached (A2) horizon. The soil is well drained till.

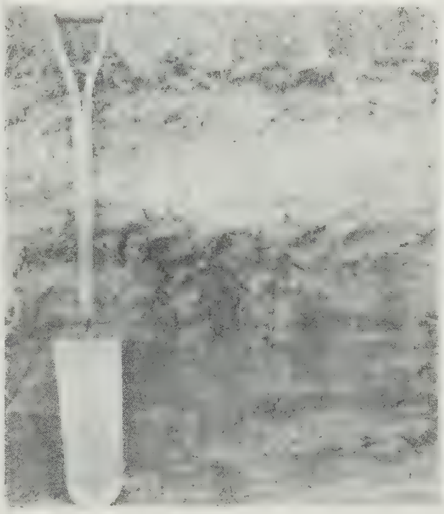
Well drained soil on the till plain with deep profile development. Note the very light (A2) horizon.

The heavy nature of the clay loam on the till plain is illustrated in this newly ploughed field.

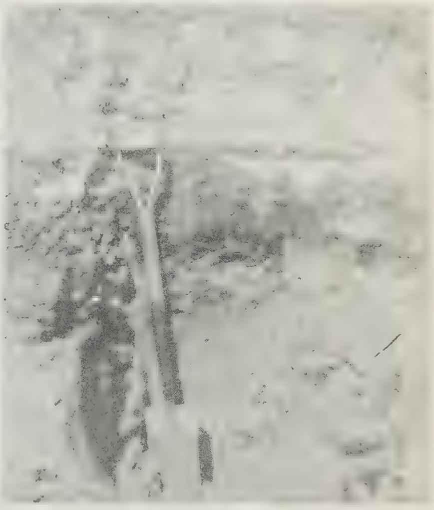
Peat deposits over marly clay near Smith Lake.



Well drained soil of the till plain. To the left of the spade can be seen the dark gray "A1", light gray "A2", dark coloured "B" horizons and the gray parent material.



Soil profile development on sand of a beach formation. With excessive internal drainage the profile is deep. The light band is the "A2" horizon, the dark coloured, freshly cut zone is the "B" horizon.



Alternate layers of silt, peat and sand in the Thedford marsh region.

the poorly and inadequately drained land has been artificially drained, the former by single line tile draining the depressions and the latter with open field ditches. It has been a general practice to leave woodlots on the backs of farms between the concession roads, on the well drained and imperfectly drained soils the trees are generally maple and beech while on the poorly drained areas they are of the silver maple - white elm group.

Where artificial drainage has not been adequate on these soils they are usually left in pasture or woodlot, where they have been adequately drained they are used in much the same way as their better drained associates. From the agricultural point of view it is generally considered beneficial to improve these soils by drainage and when this is done a soil with good crop carrying capacity results. Where, however, woodlots protect the sources of springs and streams, it is advisable to retain them so that a reliable supply of stock water is available.

6. Soils of the Spillways (W)

In this survey no attempt was made to separate the variety of soils found on the floors of the spillways. In material they range from coarse gravels to fine silts. Even the most casual observation of the spillways reveals three outstanding features, they are flat, poorly drained and are not extensively used for agriculture. Where the soil materials are coarse they are seriously lacking in plant nutrients. In their use there has always been the problem of draining them. Much money has been spent in draining them and there is very little to show for it except thousands of acres of mediocre pasture. In some places the drainage is so poor that quite deep deposits of organic soils, muck and peat, have accumulated and under favourable conditions these, when drained, have been profitably exploited for the growing of cash crops such as carrots, beans and beets.

7. Soils of the Abandoned Beaches (B)

Because these soils have a coarse texture due to sand or gravel, and because they are generally on sloping land or near a slope they are well drained or excessively drained. The profile is deeper than those of the clay soils. A photograph in the illustrations accompanying this chapter shows an exposed profile. To the right of the spade the following horizons can be identified:

A1 - eight inches of brown loam.

A2 - eight to twelve inches of light gray sand.

B - two feet of reddish brown sandy loam (the freshly exposed face in the photograph shows darker than the other horizons).

In Middlesex County soils on beaches are identified in the Burford series.

Before clearing there may have been some pines growing on these sandy soils but none remain. Well drained soils adjacent to inadequately drained soils often bear the burden of production when wet seasons preclude use of the wetter soils. Light soils were often the first cleared for the same reason. The Town of Ailsa Craig was one of the first settlements opened in the watershed because of the easily cleared, easily worked, well drained soils. Sandy soils, however, quickly loose their fertility because the organic matter is soon depleted and fertilizer leaches through them so easily. Sandy soils are now used for pasture, for small fruits and orchards or are used more intensively when heavily treated with manure. Reforestation is highly recommended for the most severely wasted of these soils. As the soils are found in long narrow strips, it was not feasible to include them in the reforestation projects recommended in this report but their inclusion in farm woodlots would be wise. One of the best tree plantations to be found on the watershed is on the soil of an abandoned beach.

8. Soils of the Lake Clay Plain (C, Cd and Cp)

It is only where conditions are ideal with respect to surface drainage that the smooth, heavy clays of the lake plain are well drained. The soil developed on well drained clay has a profile similar to that of the till plains but differs in having no stones in it. With imperfect drainage mottling is seen in the subsoil. This soil is identified in Middlesex County as Haldimand clay loam and described as follows: "Grayish to light brown clay loam over reddish and then gray gritty clay; few stones." These soils were deposited as clay on the floor of a postglacial lake with varying depth over the till deposits. That material which was actually deposited by water is stonefree, stony material is found below the stonefree clay and they are often separated by a layer of gritty clay. Because of the lesser amount of stones and boulders the soils of the lake plains have proven more suitable for artificial drainage by means of tile. When thus improved they become very profitable soils.

The poorly drained soils (mapping symbol Cp) belong to the Brookston series. Where they have been improved by artificial drainage they are used in the same way as the other cultivable clay loam soils but where they remain with poor drainage they are often covered with elms and silver maple or are left as wasteland pasture. Their high organic content makes them fertile but this fertility is not available to the usual range of crops until the soils are drained.

9. Soils of the Lake Silt Plains (C^1, C^1d and C^1p)

Silt consists of larger particles than clay and differs from clay in two important aspects. It produces a more open textured soil which drains more easily and it does not resist erosion in the same way. The silt plain was originally flat but has been cut by valleys to a greater extent than the clay plain. Thus it tends to be a little better

drained both by reason of its topography and its own internal drainage. The well drained silt soil has a shallow topsoil with a pale yellow A2 horizon and a deep yellow subsoil.

The greater part of the silt plain has an imperfectly drained soil. This soil has been identified in Middlesex County as Tuscola silt loam and is described in the published map of that county as follows: "Dark gray to brownish silt loam over yellowish mottled stratified silt and clay; stonefree."

Samples of the soil mapped as imperfectly drained silt (C^1d) in this report are very variable but with appropriate management of drainage are fairly consistent in their use. The variability is due to the layers of clay that are interspersed with layers of silt. The layers of clay impede the internal drainage which is fairly free within the silt itself. An explanation of these layers is as follows. When soil material is deposited under water the coarser materials, sand and gravel are found inshore, finer material, silt, in shallow water and the finest material, clay, in the deepest water. If a body of water becomes more shallow then sand or silt is deposited over the clay but if it becomes deeper then clay is deposited over the silt. Fluctuations in depth of water result in alternate layers of silt and clay. When the water table is high in soils deposited in this way there is a tendency for the water to remain in the clay and drain out of the silt and the resulting soil profile exhibits a pattern of blue clays alternate with layers of yellow or mottled silt. Areas with much clay near the surface will tend to be wet with correspondingly poor crop response. When these conditions are taken into account in the draining and management of the soil the best use is then made of the soil.

Some of the silt has been mapped as poorly

drained (C^1p). This has the characteristic yellowish colour in the top horizons but the subsoil consists of a gray-brown mottled glei. As mentioned before, poor drainage inhibits decomposition of organic matter and these soils are proportionately richer in humus than their better drained associates. When they are artificially drained this rich topsoil becomes available to crops.

In the well drained soils there is little difficulty in distinguishing between silt and clay, especially when they are moist and in good tilth. When, however, the silt is very dry or the profile is weakly developed, silt might be confused with clay, especially if the sample is taken from the "B" horizon, which tends to be stickier in any soil. A silt can be distinguished from a clay by a simple test. Moist silt, when rubbed between the fingers, will separate and crumble like sand, clay, when moist, will roll into ribbons. An intermediate texture between clay and silt is impossible to identify in this easy manner and requires a physical examination in the laboratory. Neither silt nor clay is found really pure, either may be mixed with the other or both with sand. A mixture of sand, silt and clay which has a loose structure but does not resemble any one closely is called a loam. A loamy mixture in which sand predominates is called a sandy loam, loam predominantly clayey, a clay loam, and silty, a silt loam. Most of the soils of the silt plain, those mapped in Middlesex as Tuscola, have a topsoil whose texture is classed as a silt loam.

10. Soils of the Lake Sand Plain (S, S/T, S/Td and S/C)

Layers of sand from a few inches to more than three feet are found lying on top of the clay of the till plain or over the clay of the lake plain. The texture of sand varies from very fine to coarse but is easily recognized as sand. There is a mixture of silt and clay in it to produce a loamy soil except where it has been sifted and redeposited by wind. Because of the loose nature of the material

the soils are well drained except where the relief is very flat there are layers of heavier material within about three feet of the surface.

Having been deposited under water, these soils are in generally flat country. There are two exceptions to this flatness, sand dunes and areas where the streams have cut steep valleys into the easily eroded sand. For the most part drainage is good except where clay is near the surface.

Where the soil is developed entirely within the sand it belongs to the Fox series. This is described in the Middlesex report as follows: "Fox sandy loam - light brown and yellow sandy loam over reddish brown loam and then stratified gray sand and gravel; stone free." Fox fine sandy loam is described as: "Grayish brown fine sandy loam over yellow sandy loam, over reddish brown clayey sand over stratified sand and silt; stone free." These are the soils that are designated by the mapping symbol "S". They have deep profiles, over three feet, with well marked "A2" horizons and deep "B" horizons with as much as two feet of brown subsoil. When cultivated the organic content of the topsoil diminishes rapidly and the soil is light in colour.

When sand lies over clay so that weathering and the soil building processes extend into the clay the soil is less well drained with mottling apparent in the lower layer of the sand or in the upper part of the clay which has been weathered. These soils, shown on the map in this report with mapping symbols S/T, S/Td, and S/C belong to the Berrien series. Imperfection in drainage indicated in the soil mapped as S/Td is not as serious in restricting cropping as the same condition in heavier soil. Indeed the water holding capacity of the clay is usually considered a benefit for most crops.

The sandy soils are used for general farming, in areas where erosion has been serious or the soil has worn out the land is pastured. In favourable locations the light

soils are used for cash crops and because of good drainage and easy working of the soil are preferred to heavier soils. When, however, they are used intensively they tend to deteriorate and revert to pasture or wasteland. Sandy soils on sloping land are subject to erosion but in certain localities in the southern part of the watershed they lend themselves to the cultivation of small fruits or are used for orchards. Sandy soils are also subject to wind erosion. Along the Lake Huron shore there are sand deposits which have been exposed to the action of wind ever since they were deposited and sand dunes are the characteristic feature of that area. Such soils are excessively drained, are not suitable to agriculture and require a permanent cover of trees to hold the soil and keep it from damaging nearby lands.

In no soils is the principle of maintaining organic content more applicable than to the soils of the sand plain. If sandy soils are included with heavier soils on one farm then barnyard manure is used on the light soils which need them the most. Where farm operations are carried out entirely within a sandy area, restriction in rotations, green manure and field composting are necessary to keep the soil in a good condition. Fruit growing is not as highly developed on the watershed as it is in some parts of Ontario so that soil management practices are not as advanced. If a permanent development of intensive fruit growing is to be carried forward more attention will have to be paid to good soil management.

11. Soils of the Clay Veneer
Till Plain (V) and Silt Veneer (L)

This soil is developed on a heavy stone free clay which lies at varying depth over the stony clay of the till plain. Deposition and reworking by water has produced a flat plain which is broken only where streams of recent origin have cut across it. Topography and material have both restricted drainage but the more open structure of the under-

lying boulder clay has offset this disadvantage to a great extent and the soils are classed as imperfectly drained for the most part (mapping symbol, Vd). A relatively small amount was so poorly drained as to be mapped as Vp.

The profile in these soils resembles those of the till plain except the colour is more brown and less reddish, the texture is heavier the subsoil is less nutty in structure. The A2 horizon is lacking or has been worked into the adjacent horizons. These soils have, from time to time, been cultivated quite deeply because of their heaviness. The comparative lack of stones facilitates underdrainage and much of the soil of this type has been artificially drained. In addition to hay, pasture and feed grain crops, there is an intensive cultivation of cash crops, roots, beans and wheat on these soils where improved by drainage.

The clay veneered soils merge into silt veneered soils and both these types are found within the area mapped as Parkhill loam in the Middlesex report. The proportion of clay and silt in the top layer changes considerably from one type to the other but both have sufficient mixture to classify them as loamy soils. The silt veneer soils may be more desirable and more intensively used than the soils of the clay plain proper. With provision of adequate drainage and under good management these soils do not present a problem to the conservationist directly. It must always be stressed, however, that the best use of the best soils is an important feature of a soil conservation program for it is only if the better soils are used to the greatest advantage that the heavy burden of production is taken off the poorer soils. It is when the poor soils are called upon to carry as heavy a burden of crop production as the good soils that they are exposed to erosion and soil depletion.

The silt veneer is proportionately better drained than the clay veneer and none of it was mapped as being poorly drained. The soil that was mapped as imperfectly

drained silt veneer (mapping symbol Ld) has a dark gray brown loam topsoil over a mottled brown or gray loam subsoil which merges into a gray silt loam or clay loam parent material. The lighter texture and generally better drainage of the silt veneer make these soils easier to work but they may not have the same inherent fertility or be able to hold their fertility as well as the clay veneer.

12. The Silty Soils of the Uplands (S^1, S^1/T and S^1/TM)

Both the Huron and Perth series are described in the Middlesex soil report as having silt loam types as well as clay loam types. In this survey and report the silty soils of the uplands are separated out from the clayey soils of the till plains and moraines and are designated by the mapping symbol S^1. Where the silt material extended to a greater depth than three feet and most or all of the profile development was within the silty material the soil was mapped simply as S^1. In localities of deep silt the topography is somewhat modified. Where the silt is found to be thinner over the underlying clay the topography is generally the same as that usually found on the till plains and moraines.

Internal drainage in the silt itself tends to be better than that of the heavier material. Restricted drainage in the underlying clay, poor surface drainage or a high water table may induce pretty much the same conditions of inadequate drainage in these soils as in the rest of the till plains and moraines which is only offset by the better internal drainage of the silt itself.

The origin of this silt is obscure and little has yet been found out about its capability. The survey of present land use suggests that it has a lower capability than the clay loams but whether this is due to a low inherent capability or to deterioration has not been determined. Much of it is now under permanent pasture.

The profile of the silty soil is similar to that of the clay loams of the till plains and moraines except that the soil is more yellowish, the A2 horizon is more pronounced and the texture is lighter. When examined on this survey it was found to be standing up very poorly to the late summer drought. Poor crop response and weedy pasture indicate that at present it is not so productive as the heavier soils on the same land forms. As so much of it is used for pasture, and as that is likely to be its future use, it is recommended that investigations be made into the fertilizer and tillage requirements of this soil.

13. Soils of Recent Depositon (BL, m and P)

Bottom land is that land which lies on bottoms of river valleys. It is subject to annual flooding and the material consists of soil particles deposited by the river. It is usually quite fertile because of this annual renewal of its fertility but is restricted in use by the flooding and the drainage, which is usually poor. Annual deposition of silt and presence of moisture prevents the formation of the soil profile with the typical horizons found in the upland soils. Organic matter deposited along with the silt as well as organic matter built up by decay of vegetation usually keeps the soil dark in colour. Much bottom land is used as wasteland pasture but where it is very wet or access to it is poor it is left in trees.

In depressions in the uplands, on the floors of some of the spillways or bottom lands and in the least drained parts of the plains there are accumulations of decayed organic matter lying on top of the mineral soil. These can be classed as "organic" soils. Where the material is wet for most of the year decay does not proceed very far and a brown peaty substance whose plant origin is easy to detect remains. This has been mapped as peat in this survey. Where aeration of the organic matter occurs there is more decom-

position and a black muck is found. Muck is seen in shallow deposits, at the better drained margins of peat areas or in places where there has been artificial drainage of the peat which has induced decomposition.

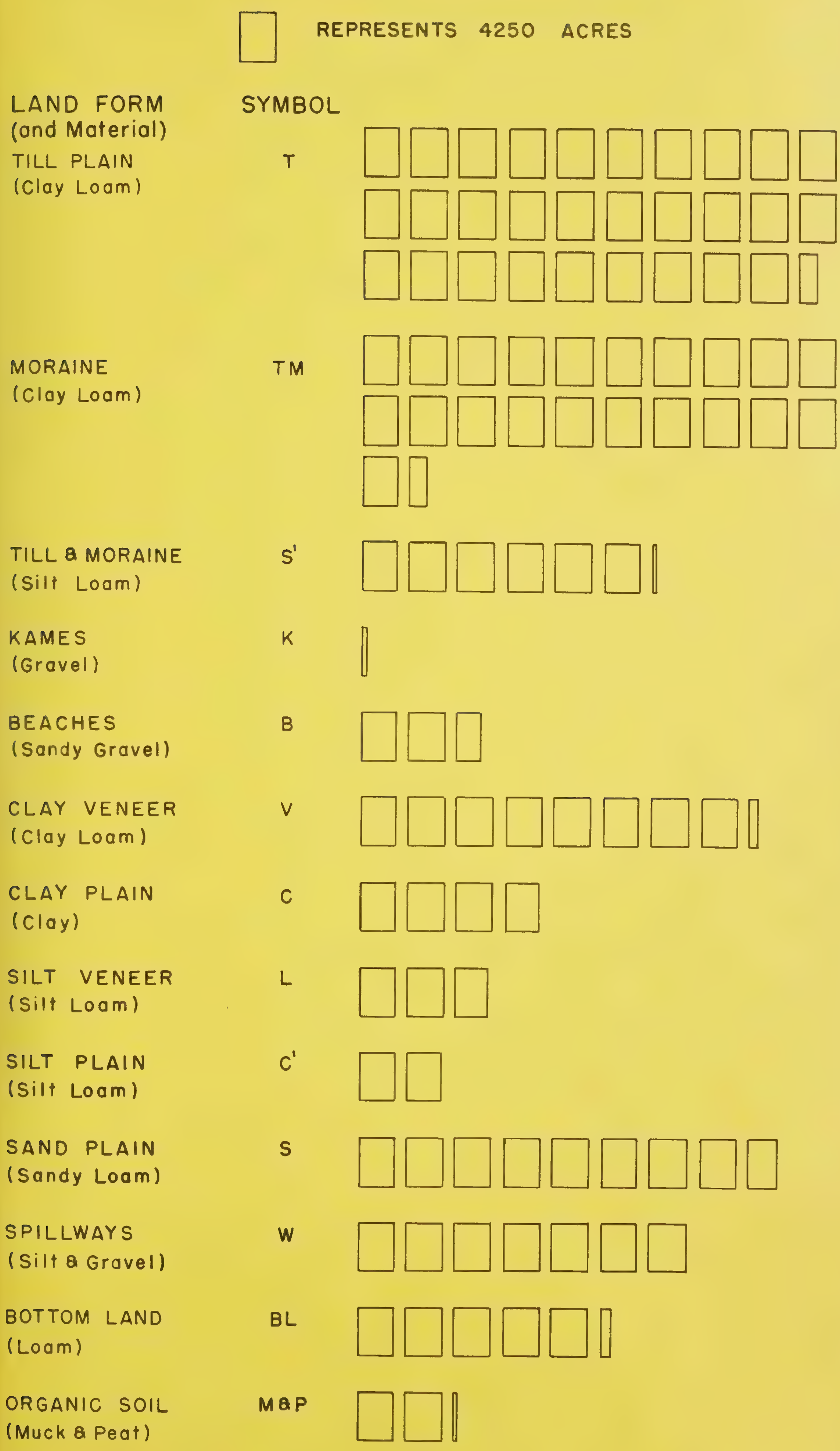
Organic soils in the Thedford marsh area have been intensively exploited for market gardening. Land use problems and floods are more acute in that locality than anywhere else in the watershed and a detailed study was made of both soils and land use which is discussed in a separate chapter of this report.

A table giving the proportion, in acres, of each kind of soil follows. The map accompanying this report indicates the extent and distribution of these soils.

MAJOR SOILS

SOIL	PER CENT OF TOTAL
Till Plain (Clay loam)	29.5
Moraines (Clay loam)	21.4
Silts and Silt loams	6.1
Kames (gravelly)	0.2
Beaches (sand and gravel)	2.7
Clay veneer	8.3
Lacustrine clays	3.9
Silt veneer	2.8
Lacustrine silts	1.9
Sands and sandy loams	8.7
Glacial spillways (gravel, sand & silt)	7.0
Bottom land	5.3
Organic soils	2.1
Water	0.1
	100.0

MAJOR SOIL GROUPS



SOIL AREAS

SOILS	TOTALS (1/100 of sq. mi.)	PER CENT	PER CENT LAND FORMS
B	1,775	2.7	2.7 Beaches
BL	3,491	5.3	5.3 Bottom Land
C	652	1.0	
Cd	879	1.3	
Cp	1,071	1.6	3.9 Clay Plain
C'	138	.2	
C'N3	25	.1	1.9 Lacustrine Silt
C'd	1,030	1.5	
C'p	34	.1	
KB	18	-	
KE	81	.2	.2 Kames
Ld	1,874	2.8	2.8 Silt Veneer Plains
M	108	.2	
P	1,286	1.9	2.1 Organic Soils
S	410	.6	
SB1	62	.1	
SE	65	.1	
SN1	329	.5	
SR3	1,181	1.8	
S/C	81	.1	
S/T	2,654	7.0	
S/T1	170	.2	
S/Td	903	1.3	8.7 Soil Plains
S'A1	680	1.0	
S'/T	1,623	2.5	
S'/TA1	582	.9	
S'/TB1	60	.1	
S'/TN1	20	.1	
S'/Td	136	.2	
S'/TMB1	441	.6	
S'/TMN1	170	.2	
S'/TA	415	.5	6.1 Silts
T	3,301	5.0	
TA	5,538	8.4	
TA1	6,388	9.8	
TB1	948	1.4	
TB3	22	.1	
TE	578	.9	
TE3	10	-	
TN	487	.6	
TN1	159	.2	
Td	821	1.2	
TdA	533	.8	
TdA1	43	.1	
TdB	697	1.0	29.5 Till Plains
TM	4,733	7.2	
TM1	439	.7	
TMA	900	1.3	
TMA1	210	.3	
TMB	914	1.3	
TMB1	361	.5	
TMB3	47	.1	
TME	351	.5	
TMN1	3,628	5.5	
TMR3	49	.1	
TMd1	1,330	2.0	
TMD	427	.6	21.4 Moraines
TMdA	120	.2	
TMdB	357	.5	
TMdB1	368	.5	
TMdE	20	.1	
Vd	5,298	8.1	8.3 Clay Veneer Plains
Vp	135	.2	
LAKE	50	.1	.1 Water
W	4,618	7.0	7.0 Spillways
TOTAL	66,024	100.0	
	660 SQ. MILES		

CHAPTER 3

PRESENT LAND USE

1. Types of Agriculture

Diversity of soils, climate, crops and marketing conditions on the watershed is great enough that distinct types of agriculture are observable. A detailed study of farms would reveal many "types" of agriculture and a very complex pattern of distribution of these types with many transitional areas in which individual farms do not conform strictly to any specific type. No attempt, therefore, is made in this report to classify farm types or to show their distribution. Most of the farms on the watershed can be considered as belonging to one or other of four types of agriculture although there are farms which would not fit into any one of them exactly. The types are as follows:-

Mixed farming with emphasis on livestock.

Beef farming.

Mixed farming which includes cash cropping.

Specialized farming for cash crops, truck gardening and fruit.

The variety of soils within the watershed has been demonstrated in the previous chapter. Major soil areas include rolling country with heavy soils adapted to grazing, hay and grain production; flat country with light soils adapted to cash crops; flat country with heavy soils and inadequate drainage adapted to cash crops when underdrained; organic soils adapted to truck gardening when managed in a special way and undulating country with variable soils adapted to pasture. The more severe climate and longer winters in the north and on the exposed slopes are not suited to as wide a variety of crops as the more temperate climate of protected locations in the south. Nearness to market by road and rail is favourable to those areas which can grow specialized crops. Industrial development of towns within or near the watershed favour specialization in

in certain locations.

Within the watershed there are grown nearly the whole range of crops to be found in Ontario. Besides good pasture and hay there are grown considerable quantities of wheat, barley and oats. Corn is grown for both fodder and husking. Sorghum supplements corn as fodder. Roots are grown both for cattle feed and for market. Flax, soybeans and sugar beets are more recent trends in cash crops; white beans have been grown for longer. Canning crops are common, red beets, peas, corn, tomatoes and carrots. Parsley, celery, onions and peppermint are grown on the organic soils. Some apples and pears are grown commercially and quite a few peaches in the south. Small fruits are often found in the orchard districts.

Holsteins, Ayrshires and Jerseys are all found on the watershed. Most of the beef animals are Herefords. Only a few operators have sheep in large numbers. Hog production is carried on with dairy production. Small flocks of poultry are seen on most mixed farms; there are a few big flocks, mostly in the north.

Any of these major types of agriculture merges gradually into the others and in any region farms may be seen which do not conform to the type of agriculture surrounding them. The distribution of these types is generally as follows:-

Mixed farming with livestock in the north-east and east with Exeter and Lucan as centres.

Beef farming in the south-east and south with Ailsa Craig and Parkhill as centres.

Mixed farming with cash crops in the west with commercial outlets in Dashwood and Parkhill.

Specialized farming in the south-west with commercial centres in Arkona and Thedford.

Movement of farm products from the area is mostly towards London, good road and rail connections are available from anywhere in the watershed towards that city.

Corn for silage and oats for feed are seen in this picture. Both these crops are adapted to the clayey soils and are related to the large scale cattle production of the region.

Under good management wheat is a successful crop on the till plains and moraines. It also thrives on the clay plains when the soil is artificially drained.

The variety of crops on this farm near Khiva is typical of the farm economy on the till plains and moraines.

Corn and sorghum for fodder. Some shelling corn is grown on the southern part of the watershed.

Hybrid varieties of corn are becoming increasingly popular.

Recent years have seen a sharp increase in acreage of flax in Southwestern Ontario. The inadequately drained clays on the watershed lend themselves to the cultivation of this crop under good management.

2. Mixed Farming with Livestock

The dairy herd is the backbone of the typical Ontario farm and this watershed contains a great many farms of which the same can be said. Grazing is provided in wasteland pasture including bottom land, on fields seeded for that purpose and on aftermath of hay. Some land is kept in meadow for hay and occasional pasture. Hay is made from grasses and legumes seeded for that purpose in the regular crop rotations. Corn silos are used on nearly every farm. Feed grains, and occasionally roots, are grown for the herd. Milk is disposed of to dairies, cheese factories and milk condensing factories or cream is sold to a creamery. Where skimmed milk or whey is available, it is usually fed to hogs. Surplus stock is sold off the farm and constitutes a major source of income to the farmer. Sheep or poultry is another source of income on some farms. Small animals, gardens and orchards are common though not necessarily a direct source of income. The soil on farms of this type is maintained in good condition by crop rotation, use of legumes and the application of animal manure.

3. Beef Farming

Large herds of beef cattle are carried throughout the watershed but the region designated above as that in which beef farming is typical has many farms on which large beef herds are carried and no dairy cattle. The basis of this type of farming is the large pasture. The morainic lands, and parts of the till plain less favourable to mixed cultivation, account for the largest part of the beef production. These include much of the silty soils described in the previous chapter. Some of the sandy areas and the wider spillways are used for the same purpose. Large scale beef production has been characteristic of these lands from the times of the earliest settlement. Some land which was previously cultivated is now under pasture. The numerous abandoned farm buildings provide evidence of this trend. It appears that little has been done to

improve either the soils or the grass mixtures to provide the pasture. Those operators who have carried out soil and pasture improvement programs stand out clearly in comparison to the average.

4. Mixed Farming with Cash Crops

The growing of cash crops of grain, roots, flax and beans which require a larger labour force or intensive mechanization is characteristic of the lake plains. The region in which mixed farming with cash crops is typical was probably a region of mixed farming formerly which has come to include some cash cropping. This region includes the northern part of the lake plains on the watershed and some of the till plain adjacent to it. Both the region as a whole and the individual farms are still flexible as to the amount of cash cropping carried on. At the time of the survey market conditions favoured the production of cash crops such as beans. Farms which are set up for mixed dairy farming, with large barns, silos and pasture lands, are seen that are carrying at least one field of beans or some other cash crop.

Some cash cropping, which involves intertilled crops, intensive cultivation and the growing of crops that are heavy feeders, is practised on land which may not be suitable for it. Erosion and soil depletion can make headway on weak soils or sloping land which gets some protection when managed for dairy production. As mentioned above, farm programs are flexible and production of cash crops fluctuates but there is a tendency, due to economic forces, for land use practices to persist even after the original reason for them has passed. Land unsuited for such practices over a long period will eventually deteriorate and the unwise user will be forced off the land because it is unprofitable, but only after the soil has seriously deteriorated, possibly beyond redemption. This presents a problem of the first magnitude to the soil conservationist. A stable balance between cash cropping and dairy or stock farming with

Root crops are grown on a large scale on the flat, clay soils as well as some of the lighter soils.

Pasture on the clay soils of the moraine. Much of the pasture land carries a dense cover of Wild Carrot (Queen Anne's Lace) which is a symptom of its run-down and inadequate condition. Re-establishment of nutritious sod cover is the great need of these soils.

A good beef herd on permanent pasture on poorly drained land.

Some sheep are carried on the wide pasture lands. Note the hills of a moraine in the background.

Chicken farming is well established on the upland stretches of the watershed. As feed is largely obtained commercially there is little relation between poultry production and soil type.

Typical agricultural land use. The woodlot in the background is on the back of the farm, a familiar feature of the landscape of the watershed.

regard to both soil and economic conditions is probably the soundest conditon for both the farmer and the country.

5. Specialized Farming

Specialized farming calls for the application of a large amount of labour per unit area of land or for intensive mechanization, or both, along with specialized skills in operating and considerable financial risk where only one, or a few related specialties are grown. There are three main groups of soils used on the watershed for this kind of farming, the light, well drained soils of the lake plains, the organic soils which are specially managed and the heavy soils of the lake plains which have been under drained.

Sugar beets, flax, beans, canning crops and market garden produce are all grown in the areas of specialized farming. Corn and small grains are also grown and the specialized crops do not exclude feed grain and fodder crops entirely. Pears, apples, peaches and raspberries are grown on the sandy soils, in some regions there is quite a concentration of farms with big commercial orchards. Within the region in which specialized crops are typical there are farms which carry dairy and beef herds and hogs and sheep. The poorer land is usually used for stock, this includes wetlands which have not yet been improved for specialized cropping and, unfortunately, land which has been used intensively and later withdrawn from intensive use for grazing. Evidence of severe soil deterioration, however, is rarely a deterrent to further exploitation of soils manifestly unsuited to intensive use.

Much of the land devoted to specialty crops has been artificailly drained by open ditches and underdrainage or both. Because these lands are on plains on the lower reaches of the river, they are subject to flood and their high economic value makes the flood problem a matter of serious concern.

6. Present Land Use Classes

Only four classes of present land use were recognized and mapped on the survey. They are:-

(i) Cultivated land: this is land which is under cultivation at the time of the survey or can be recognized as carrying a crop which is part of a crop rotation system.

(ii) Pasture land: this includes land used for grazing which has not been cultivated or reseeded within the past five years, that is, within the duration of the average crop rotation.

(iii) Woodlots: land covered by trees to the exclusion of tillage implements which may or may not be pastured.

(iv) Non-agricultural land including wasteland: (not productive of either trees, crops or pasture), urbanized and recreational areas and airfields.

The crops and rotations on cultivated land vary considerably throughout the watershed. Consideration of the types described above reveals something of the kind of crops that predominate. A detailed description of land use, separating fallow, intertilled crops, drilled crops and sod is only possible on a small area without unlimited time and personnel. Information regarding crop production by townships is available from the agricultural census and is very useful in the study of large areas but where soil features are mapped and recorded on unit areas as small as 200 acres, very little can be done to collate land use with soil conditions when the scales of measurement of the two factors are so far apart.

No attempt was made to get absolute or relative yields of crops. Again, estimates of average yields are available from agricultural statistics and census but only for larger areas. Any information that can be obtained locally, by volunteer effort, regarding distribution and crop yields over a period of years could be related to soil maps and would help a great deal in furthering a soil conservation program.

The actual location, extent and distribution of the land use classes is shown on the present land use map accompanying this report. A comparison of the amounts and proportions

of each of the use classes is given in the following table:-

PRESENT LAND USE

	Acres	Per Cent
Cultivated	214,500	50.2
Pastured	156,500	36.8
Wooded	48,300	11.3
Non-agricultural	6,580	1.5
Total	425,880	100.0

PROPORTION OF LAND USE IN EACH SOIL TYPE

SOILS	FOREST PER CENT	PASTURE PER CENT	CULTIVATED PER CENT	NON-AGRICULTURAL PER CENT
B	24.8	38.1	32.2	4.9
BL	14.6	59.2	24.9	1.3
C	7.5	41.7	50.8	-
Cd	6.8	53.8	39.3	0.1
Cp	16.33	34.1	48.9	0.6
C'	0.7	46.3	53.0	-
C'N3	8.0	52.0	28.0	12.0
C'd	13.6	24.7	61.7	-
C'p	20.6	79.4	-	-
KB	11.1	72.3	16.6	-
KE	9.9	43.3	45.6	1.2
Ld	1.5	77.7	18.2	2.6
M	26.5	16.9	55.7	0.9
P	25.5	21.7	20.6	32.2
S	8.7	45.9	44.7	0.7
SBl	16.2	17.7	64.5	1.6
SE	78.5	15.4	6.1	-
SNl	6.0	17.6	76.4	-
SR3	10.6	33.2	55.7	0.5
S/C	23.4	32.1	44.5	-
S/T	15.8	44.0	40.2	-
S/Tl	6.5	21.8	69.0	2.7
S/Td	12.9	50.2	36.9	-
S'Al	5.8	55.0	39.2	-
S'/T	4.1	29.2	66.0	0.7
S'/TAl	9.1	16.9	74.0	-
S'/TBl	5.0	43.4	51.6	-
S'/TNl	25.0	65.0	10.0	-
S'/Td	4.8	14.5	80.7	-
S'/TMBl	2.9	30.6	66.5	-
S'/TMNl	13.6	45.8	40.6	-
S'/TA	1.6	43.2	55.2	-
T	5.3	23.2	69.7	1.8
TA	26.2	25.0	48.8	-
TAl	4.7	34.0	56.3	-
TBl	7.0	41.4	51.0	0.6
TB3	-	45.5	40.9	13.6
TE	9.0	81.3	8.8	0.9
TE3	-	30.0	70.0	-
TN	11.2	18.2	70.2	0.4
TNl	9.4	32.1	58.5	-
Td	7.5	54.3	38.2	-
TdA	5.6	25.4	65.3	3.7
TdAl	2.2	97.8	-	-
TdB	13.2	20.4	66.1	0.3
TMl	22.7	75.0	1.8	0.5
TMA	3.0	13.1	78.8	5.1
TMAl	2.8	35.8	61.4	-
TMB	1.2	26.8	63.1	9.9
TMBl	5.4	28.9	64.8	-
TMB3	8.5	44.7	44.7	2.1
TME	44.4	25.3	27.7	2.6
TMNl	7.8	48.7	43.5	-
TMR3	16.3	28.4	55.3	-
TM	6.7	28.7	64.6	-
TMdl	5.1	31.8	61.6	1.5
TMdA	5.8	12.5	81.7	-
TMdB	17.8	20.5	61.7	-
TMdBl	8.4	33.2	58.4	-
TMdE	20.0	35.0	45.0	-
TMd	5.5	15.7	78.8	-
Vd	9.3	23.7	65.4	1.6
VP	8.0	34.2	57.8	-
LAKE	-	-	-	100.0
W	17.6	49.4	31.4	1.6
TOTAL	11.3	36.8	50.2	1.5

CHAPTER 4

DETAILED STUDY OF SOILS AND LAND USE ON THE THEDFORD SWAMP

1. Location and Extent

The area designated as the Thedford Swamp lies about two miles north of the village of Thedford and extends northward to Grand Bend. The western margin consists of the sand dunes called the Pinery and is marked by Highway No. 21. The southern boundary is the sand and gravel ridge north of Thedford. The eastern margin is indefinite as the land rises gently towards the east. The six hundred foot contour level roughly defines the break between the flat land of the swamp and the gently rising land to the east. The triangular area, amounting to about twenty thousand acres, enclosed by the 600-foot contour level on the Grand Bend and Parkhill sheets of the topographic maps may be taken as the extent of the swamp.

2. Origin, History and Problems

The swamp is contained between the bar and sand dunes along the present shore of Lake Huron and the sand bar which marks the shoreline of a post-glacial stage of the lake. As the water receded a bay was left at the mouth of the Ausable. This bay was cut off by a sand bar to form a lagoon. Vegetation and sediment gradually filled in the bay and lagoon until only three small, residual lakes were left, and the river wandering across the flats.

When this part of the province was settled the swamp was neglected. Settlers around the swamp gradually began to cultivate the rich organic soils but could not go far into the swamp because of poor drainage and floods. In 1875, the canal, or "Cut", as it is now called, was put through. This emptied two of the lakes, George and Burwell, and lowered the water table sufficiently to allow cultivation. The opening of the canal radically changed the course of the river and the region near Grand Bend began to be flooded. In 1892, construction of a second "Cut" was begun at Grand Bend. At

present the cut at Port Franks delivers the flow of the main river and the channel at Grand Bend takes the flow from Parkhill Creek. Lake Smith remains and the land around it is boggy and swampy. Open drains take water from the cultivated land to the "Cut" and to the river near Grand Bend.

Following the draining of Lake Burwell, use was made of the organic soils of the flats for growing specialized crops, celery and onions. In recent years large scale reclamation of the clay soils has been carried on for the production of peas, barley, flax, beans and wheat. Throughout the years, timber has been taken from the area, both independently of, and concurrent with, reclamation of the land, although forestry has never been seriously considered as an important phase of land use. Land clearing and extension of the open drain system are going on with the purpose of bringing more land under cultivation.

The problem of high water tables is apparently solved wherever open ditches are provided or tile drains are used. The very best use of the land, however, might call for a good deal of revision of the drainage system, as the use of organic soils for truck crops involves more than merely dropping the water table below the root level. Enough moisture must be retained for maximum growth of crops and the organic matter itself must not be allowed to disappear. It is not certain that existing channels are adequate to carry further discharge from additional drains, although reclamation of more land will involve extension of the drainage system.

The problem of flood is still more serious. A discussion of the areas, nature and causes of floods is given in the hydraulic section of this report along with some remedial measures. Two areas are identified, that which lies in the location of former Lake Burwell, near the "Cut", and that which is fed by the waters of Parkhill Creek. From the point of view of agricultural land use, a very important

distinction must be observed. Floods due to meltwaters and spring freshets are not generally considered detrimental, indeed by many growers they are considered beneficial in that they replenish soil nutrients and recharge the ground water supply for later use by crops. The late spring or early summer floods, which are flash floods caused by heavy rains not absorbed by the soil upstream, are the ones that cause expensive damage. When these occur, farmers lose in two main ways, the cost of replanting where crops have been washed out and the financial loss of a crop which reaches the market too late in the season to get the high prices. This latter is important because the climate favours early cropping and late crops lose this advantage.

There is, in the Thedford Swamp at the present time, a fairly large and important area of specialized crop land. There is even more land which is believed to be potentially valuable. The survey was made of the soils and present land use in a detailed way to acquire and present the facts which would be of value in planning future development.

3. The Soils of the Swamp

The soil survey map of Middlesex County classifies the soils of that part of the swamp that lies in the county as Brookston clay loam, Parkhill loam and muck, all inadequately drained soils. It is on the "Muck" soils, which include a wide variety of organic soils, that specialized crops are grown. There are three main bases of classifying the organic soils. First is the mineral material underlying them, second is the type, depth and stage of decomposition and third is the presence or absence of marl (chalky lime mixed with sediment).

The major soil materials are those all ready described in the physiography and soil sections of this report. They include glacial till (a stony clay loam which may or may not have been smoothed out by water action), and water

laid deposits of clay, loam, silt and sand at varying depths, as well as gravel deposits representing old beaches and bars. These are all glacial or post-glacial deposits. In addition, there are recent deposits of silt or accumulations of organic matter mixed with or covered by, silt.

The organic matter is derived from wood or from herbaceous water plants. Some is as deep as ten feet but most of it is from one to six feet deep over the mineral material. When the organic matter is so little decomposed that its plant origin is still readily discernible, it can be classed as peat. Further decomposition produces muck. No standard has been evolved to separate these two types exactly, but, in this report, the above generalized classification is applied. The depth of organic material has undoubtedly lessened where it has been exposed to cultivation, but there are no reliable records to indicate just how much this reduction has been. In general, the deeper the deposit, the more suited it is to exploitation as an organic soil, although various authorities differ on just how much is needed. Raw peat exposed, when land is newly cleared, is nearly useless for crops and some time is required before it decomposes enough to be valuable. The present cultivated areas have black or very dark brown muck soils. Land which is currently being reclaimed, or has yet to be reclaimed, consists of peaty material, which is brown in colour and fibrous or woody in texture.

The mineral material underlying the peat and muck has some lime in it. The soils of the upstream portions of the watershed have lime in them also. Some of the lime is washed, in solution, from the soils and deposited in still waters along with sediment carried by the rivers. The bay and lagoon which once filled the area of the swamp had limey deposits laid down in them. This substance is called marl. Its presence in the soils now has two important effects. It gives a source of lime, which, in reaction with decaying vegetable matter, produces soil that is not nearly so acid as organic soils naturally are, when there is no lime available.

In some places it forms a hard crust under the topsoil. Some operators find this an advantage, others feel that it is detrimental and break it when they are putting in drainage systems.

4. Classification of Soils

The accompanying map shows the distribution and extent of the different kinds of soil recognized on this survey. The ten soil materials listed on the map are those which are found on the surface and constitute the topsoil with which the farmer works. All the soils have poor natural drainage, that is, no real profile development can be observed, except those whose condition is marked as 'Imperfect Internal Drainage', which have a recognizable topsoil with a mottled subsoil. The other soil conditions indicated refer to underlying material at a depth no greater than three feet below the surface. Where the surface material is the same to a depth greater than three feet the nature of any underlying material is not indicated. Neither cultivation or tiles are likely to extend much below three feet and, as practically all root growth is within that depth, the nature of the underlying material has less significance. The construction of deep ditches requires more knowledge of underlying material and this can only be gained by trial and error or by a special survey with appropriate equipment.

When classified in this way there are twenty-three different kinds of soil to be found on the swamp area. The total area accounted for in this manner is 17,375 acres. Brief descriptions of the soils are given herewith.

(1) Open Water: Smith Lake covers the central part of the area to a depth rarely exceeding five feet. The bottom of the lake consists of partly decomposed plant material, lying in a structureless mass of ooze.

(2) Floating Bog: Surrounding the lake, except along its eastern margin, is a mass of floating plant material,

which lies on top of permanent water.

(3) Fibrous Peat: Extending north and south from the floating bog are areas of deep peaty material derived from the decomposition of herbaceous, aquatic plants, sedges and grasses to a depth greater than three feet.

(4) Woody Peat: Surrounding the whole area of water, bog and fibrous peat (except on its eastern edge) is an area of woody peat. This has developed from the decomposition of trees, that have grown on the edge of the marshy area.

(5) Woody Peat Over Marl: Lying south of the 'Cut' about a mile from the highway, is an area of woody peat, in which a layer of marl is found within three feet of the surface. Some of this soil is used for truck crops and some for grain, the rest is wasteland.

(6) Woody Peat Over Clay: About a mile east of the old channel of the river, below the cut, lies a belt of soil of this type. It is surrounded on three sides by clay, but at this point, an accumulation of decayed wood lies over the clay. Some of this has been brought under cultivation, the remainder being forested or idle.

(7) Woody Peat Over Clay-peat: Some of the celery beds near Thedford have been developed on a peat soil which is underlain by a mixture of clay and peat. This clay peat mixture is common throughout the area and represents the result of fluctuations in water level when organic material and mineral material were inter-layered or mixed.

(8) Woody Peat Over Sand and Gravel: In the southwestern corner of the area there is a deposit of woody peat over sand and gravel. Though this is quite near the area of intensive truck farming, it does not

carry the same crops, but is used mainly for grain and pasture. The sand, apparently, is not able to maintain the good moisture conditions required for the truck crops.

(9) Peat-Muck and Peat-Muck over Marl: This is the only soil which can be truly classified as 'Muck' and it is derived from peat. It is underlain to a great extent by a layer of marl. This is the soil which has been under cultivation for the longest and is more shallow and of lesser extent than it used to be. It is still intensively used.

(10) Clay-Peat: This is a transitional soil between organic and mineral, if one quarter or more of the soil, by volume, was peat, it was included in this class. It has developed in two ways, the deposition of clay and silt by water over peat and the mixing of peaty material with underlying clay. The first process has occurred during past and recent flooding, the second is the natural soil building process. It is accelerated under cultivation. Areas mapped as peaty twenty-five years ago, now have this type of soil. The peat, in cultivated areas, is disappearing at an alarming rate. Much of this soil has been intensively used, some of it has not yet been put under intensive cropping but will probably be used as the drainage system is extended.

(11) Clay-Peat Over Marl: Much of the clay-peat in the region of the 'Cut' and Ridge road has a layer of marl under it at about two to three feet. This has been one of the most intensively used soils.

(12) Clay-Peat Over Clay: Between the belt of clay that lies east of the Klondyke Road and the large area of peat in the south-east corner of the area, there is a large body of clay-peat which lies directly over the clay. This position between the clay and the

deep peat deposits illustrates the transitional character of the clay-peat as a soil type.

(13) Clay: This soil is that which is identified as Brookston clay loam in the Middlesex county soil survey. It is a poorly drained clay due to high water table and restricted movement of water within the clay. There is a dark gray topsoil with a mottled or blue-gray subsoil. There is some lime in the parent material and a good supply of mineral plant nutrients in the soil, restricted drainage tends to sustain a high humus content in the topsoil. It is, therefore, potentially a fertile soil and is very valuable when artificially drained.

(14) Clay with Imperfect Drainage: Although the Middlesex soil map does not show any Haldimand clay loam in the Thedford area, there is some soil of that type on the flats. A small area is found in the extreme southern portion of the area mapped. This soil is associated with the Brookston clay loam and differs from it in having a little better natural drainage. It has a grayish or brown topsoil with a strongly mottled subsoil. It, too, is valuable when artificially drained.

(15) (16) (17) Clay over Clay-peat, Marl and Sand: The first two of these types are found in the celery-growing area along with the other clay soils and are used in much the same way. Clay over sand (at a depth of less than three feet) is found along the edge of the large belt of clay east of the Klondyke road. Ditching in the clay has exposed sand at various depths under the clay throughout the clay area and, indeed, has complicated the drainage, but only in the small area designated on the map as such, does the sand come within three feet of the surface.

(18) Loam: This soil may be identified with the Parkhill loam of the Middlesex soil map. The top-soil is a gray-brown loam and the subsoil is a mottled loam. It has very few stones in it. Some of it might be classed as a silt loam. It has been formed by the deposition of silt and clay over a loamy till that has been smoothed over by water action. Inadequacy of drainage restricts its use until artificially drained. Then it is used for general farm crops.

(19) Sand: The sands of the areas are mostly on abandoned bars of the old bay and lagoons which built the whole area. Some are stonefree and some are gravelly. Except where dunes have formed, they are mostly inadequately drained because of the level topography and high water table. The sandy areas are very noticeable on the soil map because of their elongated shape. Where the sand is elevated above the surrounding land, it has been used to advantage in road building and as the site of some buildings. The sand in the southern part of the area has better drainage and exhibits a well-formed soil profile with a brown loamy topsoil and brown mottled subsoil.

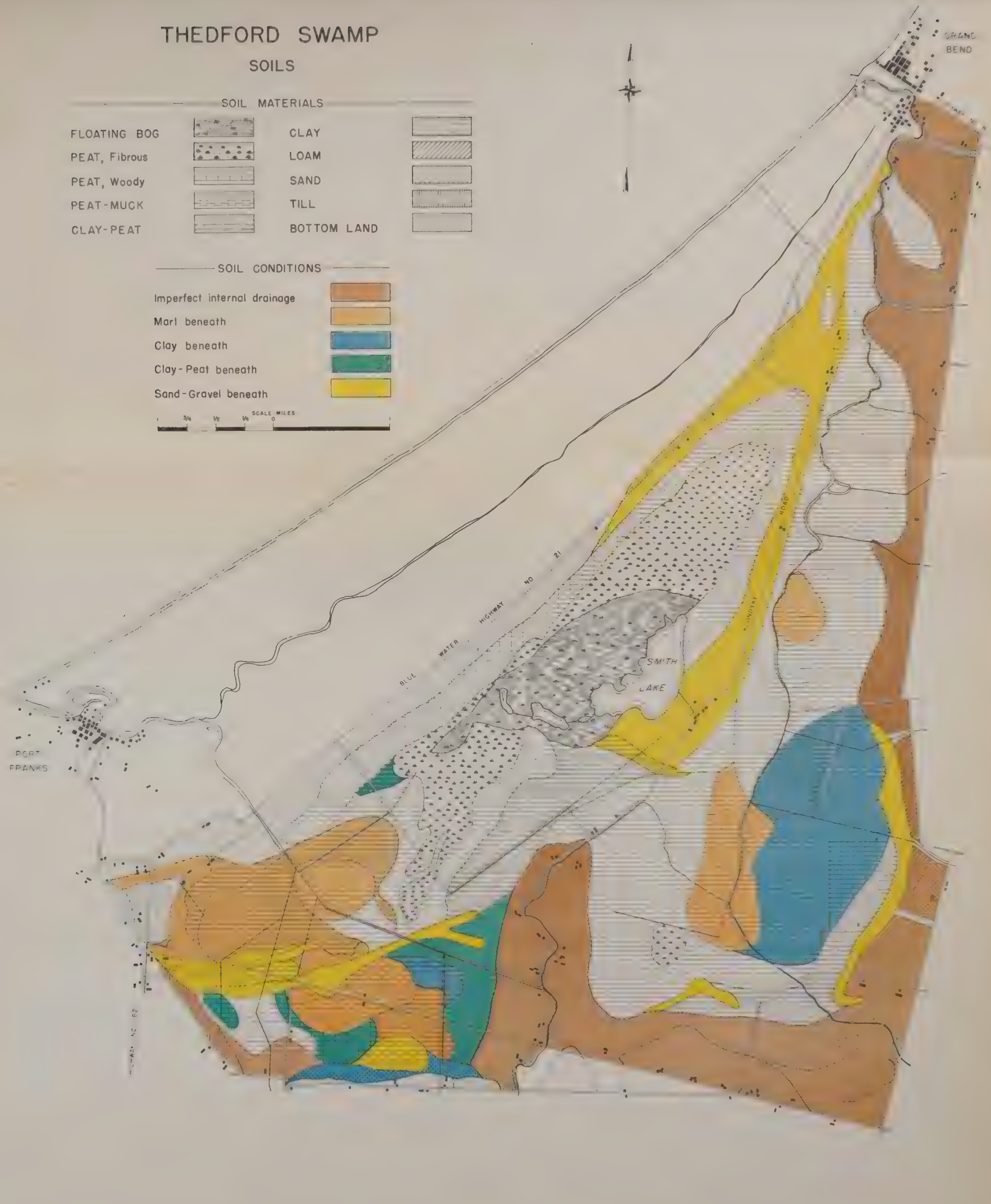
(20) Sand over Clay: A small amount of this type is found near the southern boundary of the area, there is no significant land use found on it.

(21) Sand over Gravel: Most of the sandy soils are of this type. The sandy material of the topsoil is underlain by beds of gravel. These soils influence the land use pattern in the location of roads, buildings and supplies of water. These gravel formations provide flowing wells in some places.

(22) Till - Imperfectly Drained: The imperfectly drained soils formed on till are those which are assigned to the Perth series in the Middlesex soil map. There are

narrow belts of this kind of soil along the margins of the area. This soil is not quite as loamy as that found on the uplands because it has been partly modified by water action. As it is only imperfectly drained, (with a mottled subsoil) it came under cultivation before the poorly drained soils of the flats were used. Present land use on this kind of soil merges with that of the flats. The Ridge road follows an arm of this soil along the southern boundary of the flat area.

(23) Bottom Land: Land along the courses of streams, which is regularly flooded and where the soil consists of recent deposits of sediment is called Bottom Land. In this detailed survey, the term is applied only upstream from where the stream flows out onto the flats, that is, within the area of till soils.


THEDFORD SWAMP
SOILS
SOIL MATERIALS
FLOATING BOG
PEAT, Fibrous
PEAT, Woody
PEAT-MUCK
CLAY-PEAT
CLAY
LOAM
SAND
TILL
BOTTOM LAND
SOIL CONDITIONS
Imperfect internal drainage
Marl beneath
Clay beneath
Clay-Peat beneath
Sand-Gravel beneath
SCALE MILES
3/4
1/2
1/4
0
GRAND BEND
PORT FRANKS
BLUE WATER HIGHWAY NO 21
SMITH LAKE
ROAD

The following table summarizes the amounts of each kind of soil there is in the area of the detailed study:

Soils of the Thedford Marsh

1.	Open Water - Smith Lake	314 Acres	314
2.	Floating Bog	678	678
3.	Fibrous Peat	1,340	1,340
4.	Woody Peat	472	
5.	Woody Peat over Marl	303	
6.	Woody Peat over Clay	964	
7.	Woody Peat over Clay-peat	52	
8.	Woody Peat over Sand and Gravel	1,341	3,132
9.	Peat-muck	246	246
10.	Clay-peat	856	
11.	Clay-peat over Marl	797	
12.	Clay-peat over clay	305	1,958
13.	Clay	3,041	
14.	Clay with Imperfect Drainage	64	
15.	Clay over Marl	767	
16.	Clay over Clay-peat	367	
17.	Clay over Sand and Gravel	147	4,386
18.	Loam	1,717	1,717
19.	Sand - Imperfectly Drained	596	
20.	Sand over Clay	66	
21.	Sand over Gravel	1,502	2,164
22.	Till - Imperfectly Drained	1,370	1,370
23.	Bottom Land	70	70
Total		17,375 Acres	17,375

Classes of Farms

There are two main types of farms in the area; truck crop farms and general farms. The farms are usually quite small, averaging 43 acres and as small as four and a half acres. The general farms average about 100 acres but some are operated in conjunction with other holdings not in the swamp. Truck farms are highly specialized to grow onions, celery, sugar beets, peppermint and such canning crops as red beets, carrots and spinach. General farms include a wide variety; both beef and dairy herds and pigs are kept but cash cropping of sugar beets, grain, beans and flax are the main feature of cultivation. For both types of farms it can be said that they differ from the typical Ontario farm holding, in having scattered holdings under one operator. A large part of the area is in one large holding which can hardly be classed with the other general farms, although it carries the same kind of herds and cash crops.

No continuous area of truck farms exists. There are three separated areas and each is broken by patches of other land use; the largest and oldest area extends south of the "Cut". The other two areas are north of the "Cut", one adjoining it and the other along the "New Road" and referred to as the "Klondyke Gardens".

Where truck gardening is carried on, there are no permanent houses or barns. There are only tool and implement sheds, crate shelters and packing sheds. About half the operators live on upland farms, which are operated as general farms and the other half live in Thedford or in settlements along the highway or at Port Franks.

With respect to the general farms, it was found that among 36 operators, thirty-one keep cattle, herds ranging from four to one hundred and fifty, averaging between 35 and 50. Herefords, Shorthorns and Holsteins are recognized among the cattle. Where cream is sold from the dairy

A wide view of marsh cropland seen from the gravel ridge on the south side.

A new road over the peat has been broken through the natural vegetation of the marsh.

Draining the marsh.

One of the ditches draining the marsh.

This is the second crop on newly broken land.

Peppermint oil is extracted in this distillery.

herd, pigs are usually kept, but most of the cattle are kept for beef. Grasslands on the poorly drained soils and the woodlots provide pasture. Some sheep and quite a few poultry are kept.

The cropping system generally followed has the sequence: mixed grain, seeded to clover for hay and pasture, followed by a cash crop (roots, beans, wheat, barley, etc.). In some cases wheat forms a fourth crop. Mixed grain and hay are used for the herds. Beans go to the canneries, barley to the brewers and wheat is also sold as a cash crop. Sugar beet growing was stimulated during the war and soybeans were also important.

Nearly all the farms are tile drained and there is general satisfaction with the function of the drains. A few drains are not in good repair. The herds give a fair supply of animal manure and most operators use chemical fertilizer. Buildings and equipment are in fair condition. Much of the farm work is mechanized. Increase in mechanization and further improvement of farm buildings and fences will likely come as supplies become more available.

5. Present Land Use

Ten classes of land use are accounted for on the map of present land use accompanying this report. The following gives a brief description of the classes:

(1) Open Water (Lake Smith). A permanent lake which offers shelter to wild ducks and has some recreational value.

(2) Floating Bog. This has no use at present, except as feeding grounds for ducks and no potential value in the immediate future except increase in muskrat production.

(3) Unimproved Marsh. Marshland is productive of neither agricultural products nor wood but may at some time be improved by drainage. Such a program is problematical as the marsh is adjacent to the lake and floating bog and might not be available for improvement without a

major change in the whole landscape of the area. At present, it supports a number of wild geese in the autumn and might be made to support muskrats.

(4) Slash. Woodland which has been cut over but has not been brought under cultivation, is called "Slash". It has little or no use but represents potential use either as woodland by reforestation, or agricultural land.

(5) Woodlots and Forest. Around the lake and between it and the highway there is a large forested area. Scattered throughout the agricultural land are woodlots. Both of these are remnants of the original forest cover. Nothing has been done to bring these under scientific management and scarcely anything has been done in the way of reforestation. Some of the wooded land may be cleared to extend agriculture; that which is left under trees could sustain good yields, if brought under proper management. A good deal of the wooded land is pastured. This practice tends to destroy good woodlots and the yield of pasture is very small compared to well managed grasslands.

Elm is cut off the swamp and used to make crates and boxes, used by the vegetable farmers. Cedar has been taken off in the past for posts but is not now available in any great quantity. If large areas were to be reclaimed for vegetable growing, this fortunate supply of wood might not be available. Plantations of poplar would then be useful for making crates.

(6) Fallow and Idle Land. Some of the cultivated land is left unused or in fallow according to cropping systems and market and labour conditions. Some newly broken land is left idle for a year or more until it is ready to cultivate.

(7) Pasture. Grazing is provided in two ways. Some land is left in grass far after clearing and used as waste-land or unimproved pasture. Land, which is seeded to

grass mixtures, usually yields hay and herds are pastured on aftermath of hay cutting or when hay is not cut.

(8) Grain. Besides grain, there is included in this class, flax, beans, corn and buckwheat. Feed crops and cash crops are therefore included in one class. They use the same kind of soils and are cultivated under the same management systems.

(9) Truck Crops. The areas shown on the map as carrying truck crops include, besides the usual ones - (celery, onions, beets, etc.) sugar beets and mint. These are separated on the basis of farm management and labour requirements, both of which are quite different from the Grains.

(10) Miscellaneous. Orchards, farm yards, buildings, poultry runs and various other uses cover enough land to warrant this separate, undefined classification to account for land not used in the first nine classes.

Parsley and celery. There are few buildings on the marsh itself. Much of the land is operated from farms like this one, the buildings are on the abandoned beach at the edge of the marsh.

Onions drying in the field. The production of Dutch sets is an important feature on the muck soils.

Mint is raised for the extraction of oil. After cutting the plants are dusted to kill the mint flea.

The red beet harvest. Girls from the farm service force camp handle much of the crop of the marsh.

Sugar beets.

Cattle on wasteland pasture.


THEDFORD SWAMP
PRESENT LAND USE
FLOATING BOG
UNIMPROVED MARSH
SLASH
WOODLOT
PASTURE
FALLOW
GRAIN
TRUCK CROPS
MISCELLANEOUS
SCALE MILES
1
3/4
1/2
1/4
0
GRAND BEND
HIGHWAY NO 81
BLUE WATER HIGHWAY NO 21
SMITH LAKE
PORT FRANKS
HIGHWAY NO 82

The following table summarizes the Use Classes of the Land:

Thedford Swamp - Present Land Use

	Acres	Per Cent of Total
(1) Open Water	314	1.8
(2) Floating Bog	678	3.9
(3) Unimproved Marshland	1,340	7.7
(4) Slash	2,279	13.1
(5) Woodlots and Forest	2,833	16.3
(6) Fallow and Idle Land	1,042	6.0
(7) Pasture	3,393	19.5
(Permanent Pasture	- 14.5 per cent)	
(Hay Pasture	- 5.0 per cent)	
(8) Grain	4,058	23.4
(Flax	- 9.9 per cent)	
(Grain	- 8.6 per cent)	
(Beans	- 3.3 per cent)	
(Corn	- 1.2 per cent)	
(Buckwheat	- 0.4 per cent)	
(9) Truck Crops	1,007	5.8
(Truck Crops	- 2.9 per cent)	
(Sugar Beets	- 2.1 per cent)	
(Mint	- 0.8 per cent)	
(10) Miscellaneous	431	2.5
Total Land Use	17,375	100.0

6. Land Use According to Soils

Future prospects of an area can best be determined by comparing the present use with the natural characteristics of the land. Three factors influence land use within the swamp itself. These are: (1) soil type; (2) artificial drainage and (3) accessibility. No one soil type has been completely exploited or developed because there are areas of each soil which are not favoured by the other two factors, drainage and accessibility. The soils and land use are presented in the maps, accompanying this report. Examination of these two maps reveal those crops

which have been found to be adapted to the various soils.

Two main features are obvious. The truck crops are restricted to the deep organic soils and cash crops are grown on the clays and the shallow organic soils. Sugar beets are grown on both.

The two largest areas of intensive truck cropping are on clay-peat soils (with marl underneath) and on woody-peat (also over marl). These areas cover the bed of former Lake Burwell and a swampy stretch to the east of it, which gave rise to the woody-peat. These two areas are separated by sandy ridges, which are not so intensively used. There are areas of these same soils which have not been developed for truck crops. They are mostly north of the "Cut" and are developing as they become more accessible by road and are artificially drained.

Woody-peat with clay-peat beneath is used for truck crops where it has been improved by drainage. There is still a great deal of woody-peat not yet improved and used. The oldest workings of truck gardens are on "peat-muck". This soil has developed from peat through intensive use through the years. Clay-peat is also used for truck crops.

Organic soils of the types that have proven to be valuable for truck crops cover more than 2,000 acres. More soils would be available if a large scale program of drainage and reclamation were carried out. A further 2,000 acres would be opened up.

The grain crops are grown on the clay soils. These soils are poorly drained and are only used where they are artificially drained. The same is true of the soils mapped and described as loam. There are 6,103 acres of clays and loams. Grain (including flax, in the year of the Survey), covered 4,058 acres. Much of the remainder of clay soils was either under fallow or pasture and full use of the clay soil may be realized before the organic soils are fully used.

7. Future Prospects

Further exploitation of organic soils is a possibility. Whether this is done depends not so much on the characteristics of the soil but on economic factors outside the region itself. There are four important areas of development of organic soils in Ontario; Bradford, Leamington, Erieau and Thedford. Thedford is nearly as well favoured as Leamington and Erieau with respect to climate and certainly more so than Bradford. Bradford has market and transportation advantages due to its proximity to Toronto. Erieau and Leamington are nearer Ontario markets and, in certain seasons, have access to the Detroit market. Thedford, therefore, may have to wait for many years before operations can be expanded to compete with other areas.

Two crops were found to be in a more stable position economically. There is a demand in onion-growing areas for Thedford Dutch Sets. Mint growing can expand considerably because domestic production is only a small fraction (about one tenth) of Canadian consumption of the oil. Mint growing is now being expanded in the Thedford area. Mint growing has an advantage in being less susceptible to disaster from flood.

Two major projects are necessary for expansion of operation on the Thedford swamp and indeed for sustaining present operations. These are drainage and flood control.

From the agricultural point of view, it is the summer floods which are disastrous. In the Hydraulics section of this report, there is a discussion of the relative costs of protection from spring and summer floods. Control of summer floods is much cheaper.

A feature of the use of organic soils that is generally overlooked is irrigation. Even the wettest lands are subject to drought in July and August. Maintenance of high water table is essential to good growth of truck crops.

A few operators recognize this as well as the danger of blow sand in dry periods. Impounding of water for flood control may indirectly benefit agriculture by augmenting summer flow and holding up the water table.

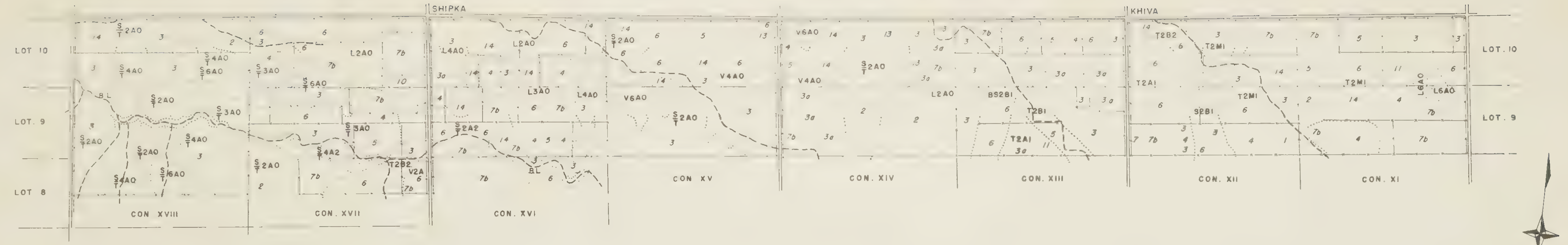
The Thedford swamp is a potential source of merchantable timber, although present supplies seem adequate for the box and crate manufacture for local use. Of even greater importance is the use of the area by wild ducks and geese. Its position with respect to the duck flyways and the potentialities of the swamp for muskrat production are discussed in the Wildlife section of this Survey report.

8. Conclusions

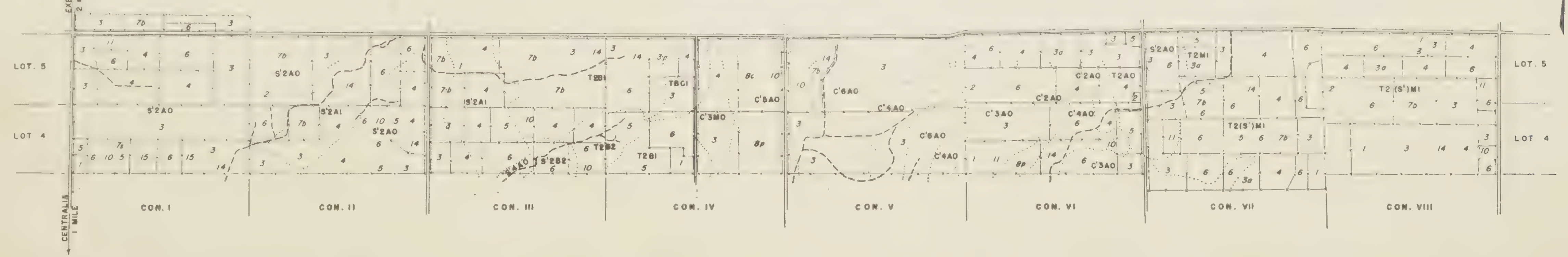
There seems little evidence of early expansion of agriculture in the area except in mint growing. Flood control measures are, therefore, likely to be limited to those which will protect land, now under intensive cultivation, from summer floods. Improved drainage involves only those drains now in existence.

Further land reclamation is not likely to be undertaken until market demands, due to a much greater population in Ontario, warrant it. In the meantime, the value of the flats for wildlife must not be ignored. Full use of the soil potentialities will involve a much greater investment in improvement than can at this time be considered. Drainage, flood control, dyking and even pumping would be necessary to bring the 17,000 acres of the area under the same intensive use that is now found on about 5,000 acres.

STRIP No. 1. LOTS 8, 9 & 10 – CONCESSIONS XI – XVIII TOWNSHIP OF STEPHEN. HURON COUNTY



STRIP No. 2. LOTS 4 & 5 – CONCESSIONS I – VIII. TOWNSHIP OF USBORNE. HURON COUNTY.



LAND USE SURVEY

DETAILED STUDY, SAMPLE STRIPS

SOIL FEATURES

MATERIAL

- S/T – Sand over loam
- V – Clay veneer
- GS – Gravelly sand
- C' – Water laid silt
- T – Loam (till)
- S – Sand
- L – Silt veneer
- S' – Silt
- T(S') – Silty loam
- B.L – Bottom land

PROFILE DEVELOPMENT

- 2 – Well drained with good profile
- 3 – Transitional
- 4 – Imperfectly drained, with mottled subsoil
- 5 – Transitional
- 6 – Poorly drained, with gray subsoil

SLOPE CLASS

- A – 0 – 2%
- B – 2 – 6%
- C – 6 – 10%
- M – 0 – 7% Hummocky

ESTIMATED EROSION

- 0 – No apparent erosion
- 1 – Less than 1/3 topsoil removed
- 2 – 1/3 – 2/3 topsoil removed

TOPOGRAPHICAL SYMBOLS

- Land conditions boundary
- Intermittent stream
- Fence
- Road

PRESENT LAND USE

- 1 – Idle
- 2 – Forest
- 3 – Permanent unimproved pasture
- 3a – Pasture in rotation
- 4 – Hay
- 5 – Silage corn
- 6 – Grain
- 7b – Dry beans
- 7s – Soybeans
- 8c – Cabbage
- 8p – Green peas
- 10 – Roots
- 11 – Sugar beets
- 13 – Fruit
- 14 – Summer fallow
- 15 – Flax

SCALE : FEET

1000 0 1000 2000 3000

JJC 6-5-7

CHAPTER 5

DETAILED STUDY OF SOILS AND LAND USE ON SAMPLE STRIPS

1. Purpose and Methods of the Study

With the time and staff available, it was only possible to classify soils and land use in a general way for the whole watershed. Knowledge of the relation of soils, crops and soil depletion which is detailed enough to use in planning land use, can only be done on a small area. Farm planners make detailed investigations of this sort on individual farms. The procedure followed in this survey was as follows: After the reconnaisance survey was made, strips of land were selected to include different types of soil, crops and farms typical of the watershed. The strips were laid out so that they would include, as nearly as possible, a row of farms. By choosing two strips on different parts of the watershed, a fair representation of crops and soils were obtained. The distribution of the crops on the different soils is shown on a map that accompanies the report.

The sample strips give a fair idea of the kinds of farms on the watershed, the crops they raise and the soils that are used for different crops. Erosion was estimated a little more closely. It is not intended to draw up farm plans for the area illustrated on the samples nor is it intended that recommendations for the whole watershed be based on the observations of the sample areas. The detailed studies are useful in illustrating, field by field, to what extent crops are related to soils.

2. Soil Types and Conditions

Most of the major soil groups of the watershed are represented in the strip. Natural drainage and soil profile development ranges from good to poor (with no organic soils represented). Slopes up to ten per cent are found.

Evidence of erosion in the soil profiles reveals some thinning of topsoil but no serious erosion. Some glaring examples of recent erosion were seen in fields of cash crops.

Types of farm included pasture farms for beef, mixed farms based on milk herds and mixed farms with emphasis on cash crop production. Some specialties were found, including poultry raising. There is a wide range of crops because of the varied types of farming. Woodlots and wasteland pasture occupy some of the poorer soils. Hay, pasture, corn and feed grain are widely grown on nearly all types of soil and are used to support beef and milk herds. Cash crops include grains, beans, sugar beets and a variety of canning crops. They make heavy demands on the soil and usually the heaviest soils are used. Heavy soils require artificial drainage and the distribution of the crops is closely related to the drains.

With respect to types of farms, it is interesting to note that, in many cases, operators occupy and work parcels of land that are separated. That is, farm holdings are not all contained within full lots or half lots but may be made up of quarter and half lots not entirely contiguous with the home acres. This feature is not represented on the map but was observed in the field. In many parts of Ontario, farm holdings, as a rule, are contained within one piece of ground. That a further adjustment has been made here is evidence that agriculture is evolving a little further from the original pattern of settlement. This may be attributed to two causes. The first is the changes in land tenure, breaking up of family holdings and resale of small parcels. The second is the deliberate attempt of operators to acquire soils suitable for grazing, particularly for beef herds. There are still instances of soils being put to uses which common experience shows are unsuitable. It is the job of the conservationist and land use planner to correct this wherever possible.

3. Mapped Features

In mapping the soil, ten different kinds of material were recognized and five degrees of drainage and profile development. Each of these factors is represented by a symbol, for example, a clay veneered till, imperfectly drained and showing a mottled subsoil was labelled V4. Slope classes and estimated degrees of erosion are also recorded and each unit of land is designated by four symbols as follows: soil material, profile development, slope and erosion. For example, T_2M_1 represents clay loam (on the till plain), well drained or hummocky topography with slopes up to seven per cent and slightly eroded. Each unit area of land which possesses similar features throughout is outlined by a boundary on the map. A table of symbols used is given on the map. The following is a description of the features represented by each mapping symbol.

Soil Material

S/T	-	Sand over loam, usually level topography with a few inches to three feet of stone free sand over stony clay.
V	-	Clay veneer, level topography with a few inches of stone free clay over stony clay loam.
GS	-	Gravelly sand, level or gently sloping, coarse sandy and gravelly loam.
C^1	-	Water laid silt, level topography, stonefree silt.
T	-	Loam (till), undulating topography, compact clay loam, some stones and boulders.
S	-	Sand, light, sandy loam.
L	-	Silt veneer, level or gently undulating topography. Stonefree, silty loam over clay loam subsoil.
S^1	-	Silt, on undulating or level ground on the till plain, stonefree, light silty soil.

T(S^1) - Silty loam, similar to the till loam with a topsoil that has some silt incorporated into it, gives a lighter soil to work than the heavy soil of the till plain.

BL - Bottom land, flat lands along main streams, subject to flood.

Profile Development

2 - Well drained with good profile; dark coloured topsoil, pale coloured A_2 horizon observable, brown or reddish-brown subsoil.

3 - Transitional; some mottling in subsoil, indicates some restriction in internal drainage.

4 - Imperfectly drained, with mottled subsoil; deeper topsoil, A_2 horizon reduced, subsoil strongly mottled, reddish-brown and blue-gray.

5 - Transitional; more poorly drained than "4", no A_2 horizon, blue-gray glei in subsoil.

6 - Poorly drained with gray subsoil, A_2 horizon lacking, some mottling just below topsoil, subsoil consists of blue-gray glei. In grassland sedges grow among the grass.

Slope Classes

I. Smooth or regular slopes.

A - 0-2 per cent

B - 2-6 per cent

C - 6-10 per cent

II Hummocky or irregular slopes.

M - 0-7 per cent

Estimated Erosion

0 - No apparent erosion

1 - Less than 1/3 topsoil removed, superficial evidence of erosion (rills and wash in freshly cultivated fields, etc.).

2 - 1/3 to 2/3 topsoil removed; thin, humus

bearing topsoil over subsoil, leached A_2 horizon obscured by cultivation, lack of humus often reflected in drouthiness of soil and poor crop response.

Present Land Use

Present land use in each field is represented by a numerical symbol. The following list indicates the crops which were observed along with the mapping symbol used.

1 - Idle; land which supports neither grazing, woodlot nor crops.

2 - Forest; woodlots which may or may not be pastured.

3 - Permanent unimproved pasture; grassland used for grazing, which has not been cultivated or seeded for a number of years (at least five, usually more).

3a - Pasture in rotation; grassland which has been cultivated and seeded within the last five years.

4 - Hay; grassland which has been seeded and cut for hay.

5 - Silage corn.

6 - Grain; wheat, oats, barley and buckwheat.

7b - Dry beans; these are threshed and beans shipped to a bean elevator.

7s - Soybeans.

8c - Cabbage; this is grown for making sauerkraut in a factory at Exeter.

8p - Green peas; for canning.

10 - Roots; this includes carrots and beets for canning as well as coarser roots.

11 - Sugar beets.

13 - Fruit.

14 - Summer fallow.

15 - Flax; grain for seed and usually harvested with a combine harvester.

4. Use of the Soils

If land use were perfectly adjusted to the capability of the soils, one would find certain crops restricted to certain soils, some crops widely distributed and some soil relegated to the least intensive use. No problem of erosion, soil depletion or poor yields would occur. There are two ways of determining the proper use of soils. One is analytical and involves a systematic, scientific analysis of the properties of soils, their crop yields and response to different treatments. The other way is by trial and error. This is what farmers have been doing for a hundred years on the soils of this district. The map showing distribution of crops on the various soils sums up the results of these many years of experimentation by the farmers. The present land use pattern, therefore, is believed to be the clearest evidence of land use capability. To what may be learned of soil capabilities locally, must be added that which has been found true by scientific observation. For example, it may be found that a certain soil is used for intertilled crops because it is easy to work, experience elsewhere may have shown that such a practice has exposed soils to erosion. The time to apply this knowledge is before the erosion has occurred, not after.

Two features are demonstrated in this detailed study. The heavy soils are preferred for the most intensive use. As these usually require artificial drainage, the pattern of land use is controlled largely by the artificial drainage. Pasture is usually relegated to the poorer soils or the naturally wetter soils that have not been artificially drained.

Distribution of specific crops on the various soils do not show any marked preference for the use of certain soils for any particular crops. Further investigation needs to be made into the relative yields on different soils. Com-

putations of yields are difficult to obtain because records are not available. A study of crop yields also requires records over a period of years. It is recommended that a study be made locally to compare capabilities of soils on the basis of crop yields. The area in which soil types, slope and erosion conditions are mapped is suggested as a good basis for such a study, because so much material is available. The River Authority and individuals interested in acquiring this information in the interests of soil conservation might choose other areas but certain basic information would have to be acquired. A soil map, in itself, is of little value unless used. One good use is to compare the crops and crop yields carried on different soils.

To those readers of this report who are not intimately familiar with farm operations the map of the sample areas is commended for their study. The setting up of demonstrations of farm planning is important in a soil conservation program. Co-operation of the operator of one of these farms in setting up a farm plan might be sought by the Authority.

CHAPTER 6

LAND USE CAPABILITY

1. Basis of Classification

There are two ways of determining the capability of soils and both are used in this survey. The first is to find how they are used in the present. This indicates how the operators have chosen soils for various uses. The second is to apply to the classification all that is known or can be found out about the ability of soil to continue to carry crops, at the same time resisting erosion and soil depletion. In many instances these two criteria give the same answer, in some they conflict. For example, in a region of heavy, wet clays, it may be found that the lighter soils are more intensively used. The light soils are then exposed to erosion and water loss and experience elsewhere may have shown that such soils cannot sustain high production indefinitely but should be protected with a permanent cover of vegetation. Thus the land under intensive use at present is classed as having a low capability and other land, not so intensively used, may have a high capability under certain forms of management. The use capability forms the basis of the recommendations given in the chapter on recommended land use.

A further determination of capability could be made by studying crop yields. Good records of crop yields on typical samples of different soils are difficult to obtain and no attempt was made on this survey to do so. The detailed study of crops on farms on the sample areas and the efficiency of these farms are the nearest that was got to measuring adjustment of land use to soils but these do not give definitely the trend over the years.

2. Present Use Related to Soils

The tables of areas given at the conclusion of the chapter on land use were used in determining the

"preference" for each soil for certain uses. An example is given of how this is worked out. Three are compared: (1) Clay loam on the till plain; well drained, flat and unwooded is 69.7 per cent under cultivation. Only 50.2 per cent of the whole watershed is under cultivation. Therefore it is concluded that operators "prefer" this type of soil in the ratio of $\frac{69.7}{50.2}$ or 1.4. (2) Soil on the till plain with gentle slopes (TA) is 48.8 cultivated, that is, to just about the same extent as the average for the watershed. The ratio here is nearly 1, that is, there is no marked preference. Loam on the till plain, imperfectly drained (Td) is 38.2 per cent under cultivation, compared to the average, that is $\frac{38.2}{50.2}$ or 0.8. That is, operators do not use this soil so intensively (in this case for the obvious reason that it is imperfectly drained). If this soil were drained, it might be used as much as the others. However, it may not be feasible to drain it as drainage might be prejudicial to the water control of the whole watershed. Therefore, it would be recommended to be left as it is, even though its capability is lower than the other soils.

No soil, however, can be considered by itself. In some cases, soil may be inadequately drained naturally, but is in a location where artificial drainage is feasible and justifiable. In other locations it may not be either feasible or justifiable to drain. Therefore, in the favoured location it has a higher capability because it can be improved and in another a lower capability.

Soils which are not intensively used for cultivated crops may be used for either pasture or woodlot. Again, present use is the first criterion of its capability. For example, the sandy and gravelly soils of the abandoned beaches (B) are only 32.2 per cent cultivated and are rated very low ($\frac{32.2}{50.2} = 0.6$). They are, however, 24.8 per cent wooded, that is $\frac{24.8}{11.3}$ or 2.2 times as intensively wooded as

the average. Soils of the till plain, with slopes over 15 per cent (TE) are not wooded at all. This is because they are narrow strips in country that is highly cultivated. Where the rivers cross the rough moraine country and have cut valleys with steep slopes (TME) the land is 44.4 per cent wooded. Again it is seen how similar soils are differently used in different locations, although their capabilities are limited in both cases by difficulty in cultivation and susceptibility to erosion.

3. Erosion

Some soils are intensively used even though their capability is less by reason of erosion and soil depletion. The reason for this present use has already been explained. Their continued use at a high level of production cannot be expected and indeed would aggravate conditions of soil and water loss. These soils include the heavier soils (clay loams on the till plain and moraines) where they are sloping or have already shown erosion. Also the light soils, both the sands and the upland silts show, besides erosion, evidence of soil depletion, mainly due to decline in humus content of the soil. The evidence is seen in abandoned farm buildings, sparse herds and weedy pastures. The management of some of the heavy soils in the past, particularly where pastured, has not improved the structure of the soil and the present state of tilth reduces the capacity of the soils.

Very little serious erosion was found in examination of soil profiles. There is, however, a great deal of evidence of erosion going on at the present. This is seen in fresh rills and gulleys and in sediment at the bottoms of slopes and between rows. A spotty catch of a crop due to lack of moisture in places is also evidence of erosion. Present markets favour the growing of certain intertilled crops, but some soils obviously cannot maintain production of these crops that expose soil to erosion indefinitely. This factor lowers

Row crops on these slopes expose the soil to serious erosion and accelerated run-off of water.

Gulley formed by headward erosion of a tributary of Parkhill Creek. Erosion has been aggravated by cattle trampling a path.

Protective cover of sod, shrubs or trees would prevent erosion on this exposed shoulder of a small hill.

A cash crop of beans has exposed this slope to erosion. In the centre of the picture can be seen a newly formed gulley.

This is another aspect of erosion. Silt deposited at the bottom of a slope has smothered the crop. Bare spots due to erosion or deposition and new rills and gulleys are the extreme examples which give evidence of erosion in progress. The insidious disease of erosion is well established before these symptoms become obvious.

The human aspect of erosion and soil depletion. These skeletons of house and barn are in a region where the decline in rural population has been made more acute by failure of the soil to sustain its yield.

the capability rating of soils which might appear to have a high capability according to present use and the preference operators show to these soils.

4. Capability Classification

To sum up, capability of soils is rated on the basis of present use and condition as well as application of what is known of erosion and soil depletion on these types of soil. Capability also depends on management and on location. Therefore, it is not possible to classify them arbitrarily, assigning each soil found to a particular class. The sum total of these factors is manifest in the mapping of recommended use, in which all the factors relating to capability are summed up. The present use of each soil type and condition is set forth statistically for the whole watershed, but present use varies from one location to another and this is taken into account in the outlining of recommendations on the map. After all, if people have found it profitable to pasture land for years and the conservationist cannot prove that the practice is deleterious to the soil and water, it would be presumptuous for him to assign another use to that land.

5. Water Supplies

A good deal of land on the watershed is under pasture and in the interests of conservation, should stay that way. There is also land which is now regularly cultivated which should, according to its capabilities be under pasture or rotations restricted, so that it is pastured more. Before, however, this capability can be translated into a recommended class, it is necessary to find whether or not water is available for watering stock. Water is derived from three main sources; wells, streams, and dugout water holes. Streams are often dry in summer and their continuous flow can be insured by reforestation of source areas. Wells tend to go dry in some areas. A general program of soil conservation is the only possible hope of restoring ground water. Dugouts

Bottom lands are regularly used for pasture. Permanent streams give dependable supplies of stock water but the stream banks are often spoiled by trampling.

Windmills for watering cattle from wells are common. Both the uplands and the plains are favourably situated with respect to the prevailing west winds.

Dugout waterholes are convenient where there is a permanently high water table. This is a common practice in the upland pasture regions.

Feeding station, waterhole and bottomland pasture. Note the gullys on the banks and slopes induced by the trampling of the cattle.

An artificially constructed farm pond. This dam catches the surface run-off from about ten acres.

A typical group of farm buildings.

are available where a permanently high water table reaches the surface in hollows. Again, maintaining a stable water table depends not on local action but on the overall program of soil and water conservation. Availability of water is a feature of soil capability when pasture is considered as a possible use.

CHAPTER 7

RECOMMENDED LAND USE

1. Basis of Classification

Recommended use is based on capability and those practices which have been found suitable on different soils. There are four main methods which have been found useful in conserving soil and water. They are as follows:

(1) Reforestation: to maintain permanent vegetative cover.

(2) Long Term Pasture: to maintain permanent vegetative cover and at the same time support cattle.

(3) Conservation Farming: the cultivating and seeding of sloping land on the contour, alternating drilled or intertilled crops in strips with grassland, provision of diversion ditches to remove surplus water from slopes and the grassing of waterways.

(4) Restricted Rotations: elimination of intertilled crops where these promote erosion, maintaining sod for more than one year in a rotation and such practices as winter cover, green manure and field composting, to be carried on where soil is susceptible to erosion but not suitable for contouring.

It must be stressed that these methods serve a greater purpose than merely holding back the flow of a river. They save, and even rebuild topsoil. They hold water in the soil that is needed for crops in dry months and capture a greater share of the rainfall to recharge the ground water supply instead of losing it in surface run-off. In the long run these practices when applied to the appropriate soils will sustain a greater return from the soil year after year.

The map of recommended use accompanying this report sums up the recommendations regarding land use where conservation methods have been adjusted to the known capabilities of the soil. For the most part the boundaries of recommended use follow the boundaries of soil types and conditions.

There is one notable exception to this in the case of woodlots. Where large areas have been set aside for public acquisition, property or lot boundaries have been followed. Also on individual farms, the progress of land improvement or the local drainage arrangements have left woodlots on certain parts of the farms wooded. These woodlots, to be maintained on a productive basis, should be fenced from cattle and allowed to regenerate within their present boundaries or even beyond. The practical thing to do would be to separate these wooded strips entirely from the ordinary field management of the farms. Where these woodlots form continuous, or almost continuous belts, they are designated in strips on the map. Smaller, scattered woodlots are ignored on the recommended land use maps. This is not meant to imply that they should be cut down, they should be retained wherever feasible even though they are on soils which, for the most part, are designated for other uses.

The significance of this land use report lies almost wholly in this map. The soils and land use maps, detailed studies and these paragraphs and numerical tables serve merely to explain and support the final map. In the study of this map, which is earnestly commended to the reader, it would be advisable to study the "pattern" of land use and not be tied to "detail". It is recognized that no programme could be devised to make the use of every field conform to the map but, it is implied that a land use pattern made to conform to the pattern of the map will, in the long run, give the greatest return from the soil of the watershed with the minimum depletion of resources in the future.

In the following sections, there are given for each recommended use class:

(1) A name and definition (with mapping symbol).

(2) Allocation of main soil types to the recommended use class.

(3) A description of methods and practices involved.

The recommended use classes are as follows:-

(1) Cultivated land, no restrictions.

(2) Cultivated land, no restrictions when drained.

(3) Cultivated land, on which conservation methods should be practiced.

(4) Cultivated land, restrictions on intertilled crops.

(5) Long term pasture, cultivated once in six years for grain.

(6) Long term pasture.

(7) Woodland.

(8) Special use.

2. Cultivated Land, No Restrictions (L)

This is land which under present conditions is intensively used and on which no special practices, over and above good farm management, are necessary to retain it in good condition. It includes level or nearly level land on the till plains, well-drained, or, in the case of silty soils, imperfectly drained. It must be stressed that the proper management of good farm land is an important part of a conservation program. Unless the land with the highest capability is used to the greatest advantage, a burden of production is put upon the poorer land which it cannot bear without being abused.

3. Cultivated Land, No Restrictions When Drained (LD)

Much of this land is now under cultivation and a good deal of it is drained, so that it can carry the whole range of crops found in the region. So long as artificial drainage is not proven to accelerate run-off and thus damage people down stream, or necessary checks are made to any accelerated run-off there might be, there is no reason why drainage might not be extended. It may be mentioned here that other classes of land will be described later, which now have extensive drainage systems which might well be abandoned. Present use indicates that little or no benefit has been derived from drainage and the areas might better be under

permanent vegetation and used as reservoirs of water.

This class of land (no restrictions when drained) include the clay veneered plain, silt veneered plain, poorly drained soils of the clay plain and silt plain and some of the imperfectly drained soils of the till plain. Not included, are those morainic areas with many poorly drained depressional areas. It is common to drain these depressions with single line tile. If the accumulated effect of these single line tile drains is to accelerate run-off, this can be checked downstream before water reaches flood areas, because the poorly drained spots are all in upland areas. When land with an irregular surface is cultivated, it is a great advantage to a farmer to have the depressions drained to facilitate cross-field cultivation.

4. Cultivated Land on Which Conservation Methods Should be Practiced. (CF)

This class is found on the till plain and moraines and includes long smooth slopes, those that are mapped "B", that is, from five to fifteen per cent. Particularly suitable examples are found on the edge of spillways and are marked on the map, but some are found which though wide enough to treat in this way, were not wide enough to indicate on the map. Some of the areas exhibit erosion on examination of profiles, others show recent erosion in the form of rills and small gullies, where the soil is exposed. The following brief summary of conservation methods is a guide to the practices that should be followed. Application of these practices should only be made, at first at any rate, under the direction of a skilled specialist. If an initial demonstration is to be made, it should be in a location in the middle of one of the areas so designated on the map, not on some special case where the same methods are not generally applicable to surrounding farms.

(1) Contour Cultivation: Fields are laid out, so that the plough and the seed drill make furrows and rows that are

"on the level", that is, do not run up and downhill. Each furrow and drill row then makes a dam which slows the run-off to a "walk-off". This not only checks erosion but makes the rain soak into the soil for later use. It also keeps fertilizer from being washed away.

(2) Strip Cropping: This consists of laying out fields in alternate strips, of cultivated crops and sod, each about four rods wide but varying with the slope. Any soil that may be washed from the cultivated strip is trapped by the sod-covered land. Laying out these strips should not be undertaken inadvisedly but only under the supervision of a trained expert. Once this practice is adopted in a region, more experienced people are available to help novices set up their strips. Inept and bungled attempts to contour fields and lay out strips sometimes have disastrous consequences and the whole movement towards conservation practices can be prejudiced. In this regard it may be mentioned here, that the map outlining recommended land use, in this chapter, indicates the areas where these methods might be practiced and demonstrations set up.

(3) Diversion Ditches and Grassed Waterways: All of the rain cannot always be induced to soak into the ground even under the wisest management. Provision must therefore be made to remove excess surface water with the least damage to the land. The main remedy to this problem is the grassing of all channels which regularly carry surface run-off. A good sod covering prevents gullying, collects silt and delivers water to permanent streams in a clean condition. If made wide enough, for example, equal to double the length of a mower bar, they can readily be used for hay.

A special device is the diversion ditch. This is cut across the slope of a hill and leads to a grassed waterway running downhill. The purpose of it is to catch the water from uphill land, run it across the hill and lead the

water down hill in a safe way. If a lower part of a slope is cultivated, then the run-off from the upper part is kept from washing across the cultivated land.

(4) Restricted Rotations, Winter Cover , Green Manure and Field Composting

The one feature of soil which, above all others, makes it resist erosion, absorb water and hold it is its humus content. Experiments have shown that soil in fallow or under corn resists erosion and holds water better when the previous cropping has added humus to the soil. Having sod cover for two or three years in five rather than just one is a soil building measure. This restricts the rotation but, in the overall management, can give a higher yield. Winter cover, such as rye, protects the soil against erosion by fall and winter rains and spring thaws and also helps to build up the humus content of the soil. Green manure means plowing under a crop for the purpose of building up the soil. Buckwheat and rye are commonly used. Legumes in the green manure crop add nitrogen.

Composting, as commonly practised by gardeners, is usually considered out of the question by farmers because of the great amount of labour required. It is regrettable that this dismisses the question entirely. It cannot be denied that a great deal of plant residue is wasted on most farms. Much of this residue is too deficient in nitrogen to be quickly and readily decomposed. This applies particularly to straw, cornstalks, and sawdust. A good deal of available nitrogen is lost in the liquid manure from stables and barnyards. In Britain and Europe, farmers have devised ways of trapping it and mixing it with straw, which when rotted is handled like stable manure. It is even applied directly to the fields in an implement like a seed drill. Any device for conserving liquid manure with its high nitrogen content, particularly so that it will help compost and return plant residue to the

soil would do a great deal to improve and sustain the soils of Ontario.

Field composting is a system which can readily be applied in Ontario farming. It involves two things, the distribution of waste (straw, sawdust and cornstalks) in the fields and addition of enough nitrate in the form of commercial fertilizer to bring about rapid decomposition of the waste. This is incorporated into the top-soil to build up the humus content.

Any practice which returns plant residue to the soil builds fertility, checks erosion and increases the water absorbing and holding capacity of the soil. It is especially important on land which is sloping and erodible, but which has an irregular surface which is not suitable for contouring and strip cropping.

5. Cultivated Land, Restrictions on Intertilled Crops (LR)

There are some crops which leave a good deal of the soil bare and require cultivation of the soil throughout the growing season. This leads to erosion when the soils are on sloping land. These crops include corn, beans and roots. It is generally recognized that these crops are heavy feeders and tend to wear out the soil. Fertilizer programs are followed in the cultivation of the crops but little attention is paid to the danger of erosion. Evidence of erosion is very obvious but the end result may not be apparent for years. The areas designated as having restrictions on intertilled crops include erodible soils on which these crops should not be grown, of, if grown should be kept to the most nearly level land and grown not too frequently. They include some of the moraines and the more undulating parts of the till plain.

While markets are good, there is a tendency

for cash crops to be extended from the soils which were originally found suitable onto soils less suitable. It might be expected that this tendency would be reversed when economic conditions deteriorate. Wise land use would then be brought about by economic pressure, crops would not be retained on land unsuited to them. This, however, is not the way it works out. Once processing plants are set up and the necessary labour for cash crops congregated, there is a tendency for that type of farming to persist. No major problems have arisen in the watershed to compare with the devastated areas of the Southern states, but the principle is the same. The conservationist and the land use planner can forestall the deterioration of an area by seeing to it that the type of agriculture and the methods of farming are kept in line with the soil capabilities. The best time to start controlling erosion is before it gets serious, not after it has dragged down the whole life of an area.

6. Long Term Pasture, Cultivated Once in Six Years for Grain (PL)

There are two main kinds of soil assigned to this class, the heavy soils (including some imperfectly drained), which are hard to work and the light soils which have little "body". The former include clay loams on the moraines (TMl), and imperfectly drained soils on the till plain (TdA and TMd). The latter include the silty upland soils ($\frac{S^1}{T}A$, $\frac{S^1}{T}$) and sandy soils ($\frac{S}{T}$). Reference to the present land use map (or to the statistical table) shows that much of the land is pastured now. That which is cultivated is largely under grain; wheat and barley on the well drained land and oats on all types.

The soils in this class require building up. They are either lacking in humus or are in poor tilth, or both. On sloping land they are subject to erosion. Neither crop yields nor animal carrying capacity of pastures are high.

Improved pasture would improve these soils in every respect.

Once the fertility requirements are calculated (from soil analysis), a suitable method of tillage chosen and a good grass and legume mixture selected, the land can be reseeded to pasture. All these steps require more research to determine correct action. Tests should also be made to establish the longevity of mixtures, that is, how long will the legumes and nutritious grasses remain. Six years has been chosen arbitrarily in designating this type, actually pastures may be held for as little as four years, possibly for as long as ten. The improvement of pasture has four good results: (1) Gives a better return in beef or milk from the land, (2) improves the texture of the soil, (3) resists erosion on sloping land and (4) brings the soil to a better state for growing crops. Grain is then grown as a regular crop. Hay may be cut as found suitable and as required. Breaking the sod and seeding to grain can be carried out as a regular part of this long rotation. This system not only preserves the soil but meets the economic requirements of an area which is fairly well established as a beef or dairy region.

The conservationist, in his survey, finds the facts of soil and land use. Many of the remedial measures are known. The place where these can be applied is indicated. The actual implementing of a program depends on the operator. He has economic conditions to contend with, availability of capital and reliability of the market for his products. It is then up to the farmer to obtain the best technical advice he can from trained agricultural economists and arrange his program to fit his farm production to the capabilities of the soil.

7. <u>Long Term Pasture(P)</u>

Long term pasture means land which is prepared and seeded to grass and legume mixtures and used for grazing. A crop of grain, used as a nurse crop, may or may not be taken

off the land the first year. The duration depends on the length of time that a good yield of nutritious grass is available.

The length of time the land is left uncultivated is longer than the ordinary period of crop rotation. For greatest returns and benefits, it must be managed properly, fertilized and kept free of weeds. It is possible to renew the mixture by reseeding without ploughing under. This practice is not generally followed in Ontario, partly because methods for so doing have not yet been worked out fully. The maintenance of good pasture is an important part of soil conservation in both Britain and the United States but Ontario conditions are not quite like those of these two countries.

In the matter of pasture it is worth noting that grass is our most important crop, both in acreage and the part it plays in our agricultural production. Improvement of pastures is essential to increased production and is our greatest weapon in the fight against soil depletion and erosion.

The soils that have been assigned to this recommended class are the steepest and the sandiest of the agricultural soil. Soils that are found to be too poor or rough to cultivate are often relegated to pasture, usually without any effort to improve them. Most of the land for which this is recommended is now under sod. What is required is a program of rehabilitation of the soils to bring about the two objectives mentioned above, viz. greater yield and the protection of soil and moisture. Thin, overgrazed, dried out pasture, covered with weeds and hawthorn is poor grazing and does little to hold soil and water. Lush, springy, thick turf is not only good grazing but it covers the land with a blanket that holds both soil and water.

When land is either relegated to pasture or specially seeded to pasture, it requires further management. The three main features of good management are: (1) preventing over grazing, (2) dressing with manure and (3) mowing to cut

down weeds. To prevent overgrazing is just a matter of not keeping too many animals on one pasture, and restricting use in dry periods. Dressing with manure can be done the same as in preparation for a crop, but in this case, the crop is the grass already there. Animal droppings in the field, raked out, serve the same purpose as a thin dressing. As to weeds, some are eaten by cattle but are not very nutritious. Others are left by the animals and, in growing, crowd out the grass. Weeds are not the soil builders that grass and legumes are. Mowing the pasture, at least twice in a year, will prevent weeds, both early flowering and late flowering, from propagating. It also keeps down Haw and apple, the presence of which is a great indicator of poor pasture.

8. Existing Woodland and Reforestation (F)

Zones have been outlined for reforestation and preservation of existing woodland. These are described in the section of this report dealing with forestry. They are located on the sand dunes along the Lake Huron shore, in the region known as the Hay Swamp, on parts of the river and in various source areas. The forest zones are large enough to include a number of whole properties so that they might be acquired by the Authority by purchase.

Smaller belts of woodland are indicated on the recommended land use map. These are not large enough to be included in Authority projects but include parts of farms. Therefore, the maintenance of existing woodlots and reforesting of plantable land is a phase of farm management. There are existing woodlots (shown on the present land use map) which are too small and too scattered to include in the recommended use map and it is to be understood that the preservation of these woodlots under sound management is a part of the general conservation program for the watershed.

The soils that have been designated specifically for forest are the gravelly soils of the Kames and abandoned

beaches (K and B), spillways (W), bottom land and the steepest slopes of the river valleys. Long rectilineal strips of woodland are outlined on a variety of soils, both on the uplands and the flat country. This merely confirms and systematizes the existing conditions, namely, the presence of woodlots along stream valleys and on the backs of properties. The cardinal feature of woodlot management is the exclusion of cattle. This involves fencing the woodlots and it is considered cheaper and easier to build fences in straight lines. Indeed, existing woodlots conform quite well to this pattern.

There are many advantages in a well-kept woodlot. It costs little to establish one. The biggest cost is the fencing. In many cases this already exists. The exclusion of cattle means the loss of some pasture, but it is not hard to see this loss made up by the improvement of pasture elsewhere on the farm. When annual cutting is kept within annual yield and the forest is allowed to reproduce itself with new growth the following are some of the advantages:

(1) Regular supply of fuel and timber.

(2) Yield of maple syrup in maple bushes.

(3) Shade for cattle along the fenced margin.

(4) Shelter for birds that destroy insects and mice.

(5) Wind shelter for fields.

(6) Protection of sources of streams.

It would not be feasible to reforest all the land designated as plantable because it would not fit into individual farm plans. The map merely outlines those areas suitable for woodland and for which reforestation is recommended to be carried out when possible.

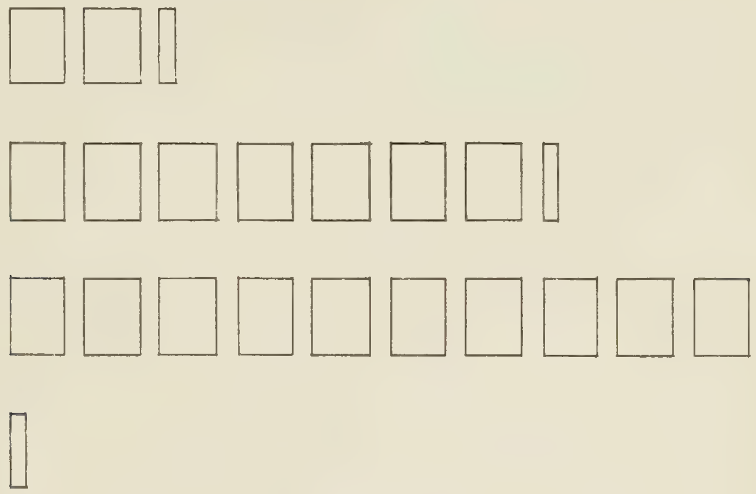
9. Truck Crops, Market Gardens and Orchards (SU)

Organic soils and some of the very light soils are particularly suitable for the establishment of market gardens and orchards or for the growing of truck crops on farms which are able to include them in the farm plan. There appear

PRESENT LAND USE

REPRESENTS 21,250 ACRES

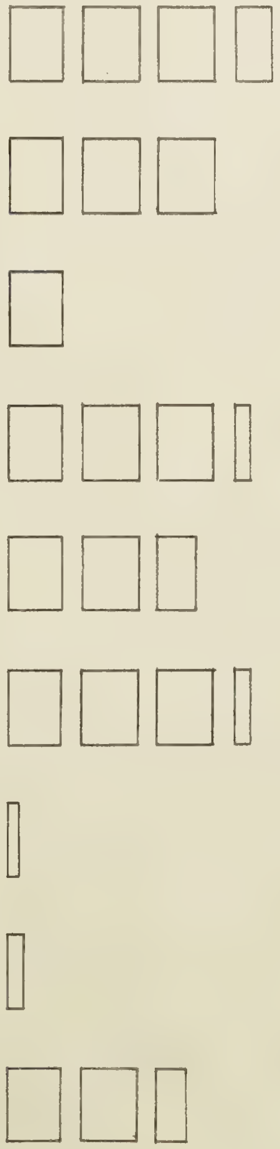
LAND USE	SYMBOL
FOREST	F
PASTURE	P
CULTIVATED	L
NON-AGRICULTURAL	X



RECOMMENDED LAND USE

REPRESENTS 21,250 ACRES

LAND USE	SYMBOL
UNRESTRICTED	L
DRAINABLE	LD
CONSERVATION FARMING	CF
RESTRICTED	LR
PASTURED	P
WOODED	F
SPECIAL USE	SU
PERMANENT VEGETATION	P/F
PASTURED & CULTIVATED	PL



to be greater areas of these soils than are at present required for the products of this kind of farming. Therefore only those areas which have so far been exploited for this purpose have been designated as special use areas on the map of recommended land use.

Orchards on sandy soils expose the land to erosion. There is a need for study of modern methods of soil management in orchards on the watershed

10. Permanent Vegetation (P/F)

Reference has been made to the land forms called "spillways", the poor capability of these soils and the relative unimportance of their use. Although drainage ditches have been put through them in the past, there is little in their present use to show that the ditches were worthwhile. Most of the spillway soils are specifically recommended for either pasture or forestry. There is some of the area in which either use may be made but neither is specifically recommended. This alternative possible use is indicated on the map by combining the colour symbols of both types in alternate bands. This area is at present used almost exclusively for pasture and woodlot. Its chief value is for water storage and possibly as a source of merchantable timber if the tree cover were allowed to mature.

11. Water Supplies for Grazing Land

Emphasis has been placed, throughout this report, on grassland as a conservation measure. Grassland would, of course, be used for pasture. This brings up the problem of water supplies.

Wells are usually considered as one source of water for livestock. Permanent streams are another. Sometimes well water is not available or drilling is too costly. Many former streams now dry up in summer. Power for pumping is not ordinarily available except electricity at the barn or windmills in open fields.

There are two alternative sources of water,

surface run-off and ground water in shallow dug-out water holes. Efforts to catch surface run-off into ponds are not common. Dug-out water holes are, however, common on the watershed. Artificial farm ponds to catch surface run-off are likely to be more common in the future. Investigations into suitability, type and cost and management of farm ponds are necessary in rounding out a conservation program.

Present use of surface water for watering stock is not entirely satisfactory. It is common to allow cattle free access to the whole margin of a stream or pond. The trampling of the cattle exposes soil to erosion. In the case of streams this aggravates the muddying and silting-in of streams. As to ponds, it takes only a few years to spoil a pond completely and that which was originally a clean pond becomes a muddy, sedge-covered slough of little use in watering cattle.

Proper management of surface water supplies calls for the exclusion of cattle from the margins of watering places. Where downhill, gravity feed is possible, cattle can be watered from troughs. Where it is not possible, an arrangement can be made to restrict access by a fenced lane. This approach to a water hole can be changed occasionally, especially where an electric fence is used, so that the trampled parts become covered with sod.

12. <u>Effectuation of a Program of Soil Conservation</u>

Except where large pieces of land are required by the Authority or the county for reforestation, all changes in land use would be made on individual farms. Action and responsibility, therefore, will be assumed by the farmers. It is the concern of the Authority as to: (1) what should be done, (2) where and (3), by what means and agencies. The foregoing paragraphs outline the remedial steps for soil and water conservation. The accompanying map shows where the problems and remedies lie.

13. <u>Farm Planning</u>

Farm planning is the first step in bringing

about wise land use. Technical advice in farm planning and special methods of soil management are available from the Agricultural school through the county agent. The farm planning service of the soils department at the Agricultural school has specialists who can lay out fields and arrange rotations so that the cropping systems of the farm are adjusted to the capabilities of the soils. The River Authority can help to get farmers and planners together and to arrange for demonstrations in key localities.

14. Demonstration

Demonstration is the proven way to introduce farming methods. This can be done in two ways, by co-operation with private farmers or by operations on land owned by the Authority. If the Authority acquires land for reforestation, dam building or recreational use and farm land is included in the property they acquire, then a splendid opportunity is there for demonstration. This is particularly applicable to pasture improvement. There is no reason why public held land cannot be improved for pasture and rented to nearby operators.

15. Experimentation

Experimentation is necessary to find out just what practices and methods are suited to various soils. The River Authority is the biggest organization directly concerned in conservation and can give strong leadership in establishing experiments in land use in the region in which they are specifically concerned. Two lines of investigation are here suggested for improvement of soils on the watershed, (1) establishment of nutritious, soil-building sod on slopes too steep for safe cultivation (possibly by "trash-mulch cultivation", that is, spreading fertilizer and reseeding on scarified sod without breaking), (2) fertilizer requirements, seed mixture and tillage practices on the heavy, clay soils.

16. Education

Education is the most important feature of a

conservation program. It is not suggested that older people are beyond education, but it will be the younger folk who bring a conservation program to fruition and the young people are more readily accessible through schools as well as youth organizations. Therefore, the suggestion is made here for a conservation education program among young people.

People are more likely to act upon what they learn themselves than what is merely taught to them. Competition also spurs effort. Experimenting in conservation methods, pasture improvement and managed woodlots among young farmers should bring home many lessons in soil conservation. High School students or public school teachers taking university courses can make original surveys. The information acquired and the intellectual exercise involved in making investigations would be a great educational force.

Some of the things which might be studied by local young people include the following:

(1) Comparison of crop yields on different soil types.

(2) Comparison of crop yields on eroded and uneroded soil of the same type.

(3) Distribution and density of weeds in a school section or part of a township (to follow studies made in weed collections).

(4) Distribution of certain specific crops, e.g. alfalfa.

(5) Wildlife field studies, e.g., occurrence of birds, valuable in destroying insect pests.

These can be made supplementary to courses in Geography, Agriculture and Biology. A competitive element sustains enthusiasm and the educational value is far greater than any amount of class room instruction.

17. Discussion

Discussion has been recognized as a means of education in the Farm Forums which are now a flourishing feature of rural life. It is intended that the map of recommended

land use be helpful in group discussion. Problems differ in one part of the watershed from that of another. Thus, if soil conservation were the subject of discussion, it would follow that, erosion control would be the main theme in one area, drainage in another and pasture improvement in a third. A forum with representatives from two types of land could study the reconciliation of drainage with run-off control.

18. Co-operation

Co-operation is the means of achieving goals that cannot be attained by the individual. The men who first brought the land under the plough were pioneers. Those who strive to restore and maintain the fertility of the soils, the conservationists, are pioneers of the future. Co-operation between them is as essential as it was in the old time "Bees". A tree planting bee is a practical example of the old spirit. Land use planning is a more modern aspect. A sensible approach, for example, to the problem of supplying pasture, might require a little co-operation. A dairy breeder, in search of grazing for a herd of heifers, might just as well rent land where pasture is the wise use of the soil as to rent it where it just happens to be available. A little forethought and planning can bring this about. It needs only the consciousness of the problem to find the answer.

The adjustment of land use to soil capability is a very long term program. Knowledge is the first step. The maps and discussion presented here are intended to provide some of that knowledge.

CHAPTER 8

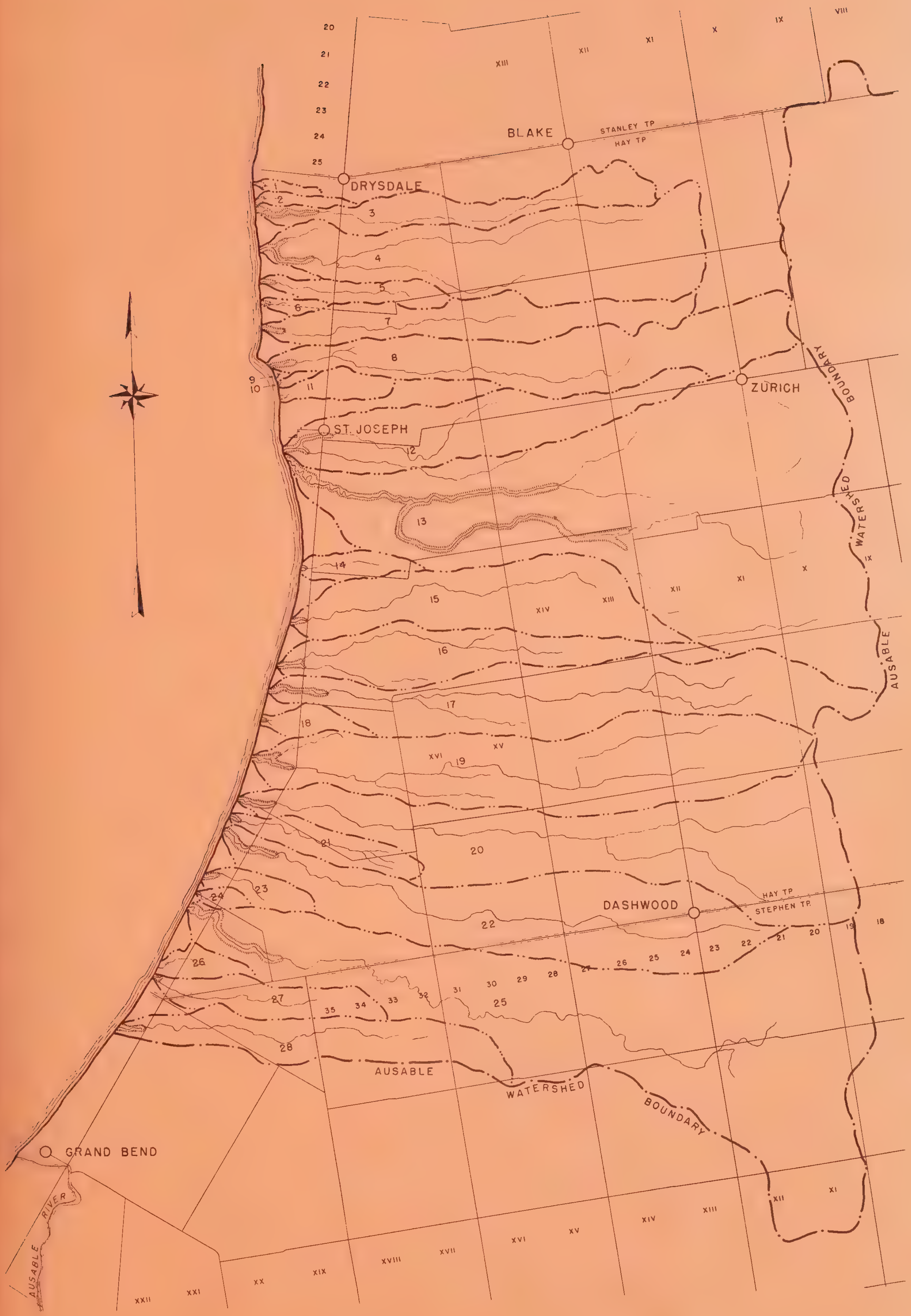
GULLIES ON THE LAKE HURON SHORE

The shore of Lake Huron from Grand Bend almost to Clark Point rises as bluffs from fifty to seventy-five feet high. The material of which these bluffs are composed is a reworked boulder clay with very few boulders remaining in it. When the natural vegetation is removed from the face and crest of these bluffs they become very subject to erosion and where run-off and drainage from further inland is accelerated by means of ditches and tile and the water allowed to run over the cliff face uncontrolled, gullies cut their way into it in an alarming and dangerous manner.

At the time the survey of the Ausable Watershed was made, twenty-eight of these gullies between Grand Bend and Drysdale were examined. These twenty-eight occur in a distance of ten miles along the shore which makes an average of almost three to the mile and they vary in length from fifty feet to almost four miles.

A few of these were present at the time of settlement as steep-sided ravines running a short distance back from the shore, but at that time they were completely stabilized by forest cover. The majority are entirely man-made, mostly within the last fifty years. The steps in their development and the factors contributing to the rapid rate of cut-back are:-

1. Removal of forest cover.
2. Increased and accelerated drainage.
3. Installation of drain tile.
4. Not providing a conduit for carrying the water down the cliff face to the lake level.
5. Straightening of the drainage channels.
6. Cultivation of fields right to the edge of the gully.



GULLIES

LAKE HURON SHORE

(GRAND BEND TO DRYSDALE)

1947

GULLY NUMBER 12

ERODED SECTION

SCALE = MILES

1 1/4 1/2 3/4 0

DEPARTMENT OF PLANNING AND DEVELOPMENT

Slopes badly in need of revetment, riprap and ground cover.

The head of a gully requiring a flume to carry water to the floor of the gully.

Provision should be made to carry water to the floor of the gully by means of conduit.

This part of a watercourse is almost four miles from the mouth of the gully it has created. Sloping of the banks and establishment of ground cover is required.

Where the natural ravines existed originally, there is still a certain amount of tree cover protecting the mouths of the gullies and in some places, other cover such as grapevines, sumach, red-cherry and chokecherry are preventing erosion on the sides, but in most cases, erosion at the heads of the gullies and branch gullies is proceeding rapidly. The rate of recession is not constant and varies greatly from year to year. In some periods, there may be no increase in length for some years and then when conditions become favourable, the gully may advance fifty feet and more in a single season. The worst season for the advance is in the spring when the frost is coming out of the ground and the run-off is greatest. Gully Number 20 (see accompanying map) is reported to have cut back 1,100 feet between 1907 and 1912, or an average of 220 feet per year.

Spasmodic and inadequate steps have been taken to arrest the progress of some of these gullies, particularly when they began to menace Highway Number Twenty-one. In most instances, the Ontario Department of Highways built large concrete conduits under the road with broad aprons and in some cases constructed one or more concrete check dams. These structures were well-built and arrested the rate of cut-back for some years, but nearly all of them are being undermined or by-passed, because no provision has been made to stabilize the banks near them and inadequate aprons and retaining walls were provided. In the case of Gully Number 25, the original natural ravine was straightened to get the water away from the highway more quickly and erosion was actually increased by the acceleration of the water.

Private owners have made some attempts to arrest erosion in some of the gullies by dumping in brush and planting trees, but in most cases the attempts have lacked method, work done has been patchy and inadequate and success very meagre. Probably the most successful effort has been

Sump and conduit at head of gully.

Cover well established.

Natural white cedar on a stabilized slope.

Natural tree cover in the original ravine. Gully has formed further up as the tree cover was removed.

carried out by Dr. Read on Gully Number 26. He has built a catch basin at the head with an outlet at the floor of the gully and has constructed several small check dams. He has spread hay, branches and fence wire over the sections where erosion was taking place most rapidly, and has sown alfalfa and planted trees on the slopes. His is a co-ordinated plan, in which he has used all accepted methods of gully control and has tackled all parts of the gully at the same time.

When only one phase of protection is carried out at a time or only part of the gully is treated, the work done may be rendered useless in a very short time by erosion taking place on the unprotected parts. In all work of this nature, a plan must be made for each gully and the work to be done outlined in all its phases beforehand. This should include consideration of and plans for one or more or a combination of the following:-

1. Sumps.
2. Flumes.
3. Check Dams.
4. Aprons
5. Retaining walls.
6. Rip rap.
7. The spreading of brush, hay, fence wire and debris.
8. Sowing cover crops, such as sweet clover and alfalfa.
9. Planting trees, shrubs and vines.
10. Sodding.

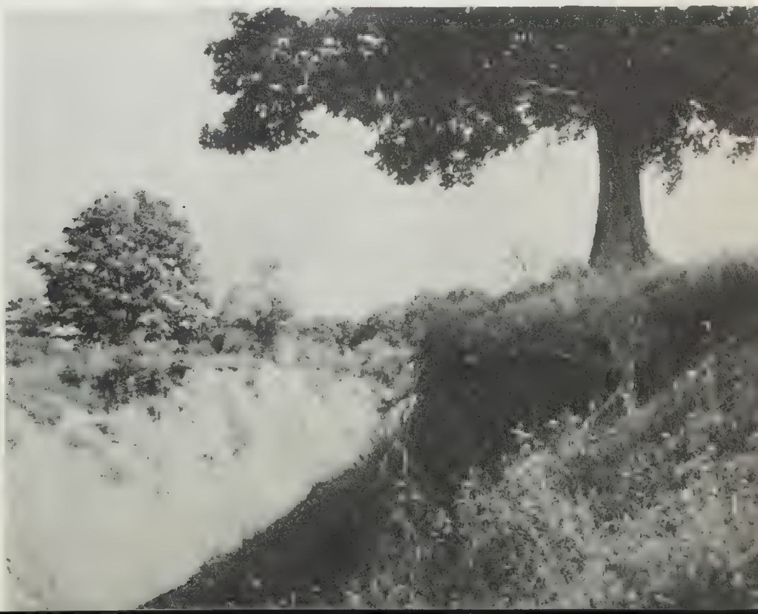
When the plan has been prepared and the required work properly integrated and decided upon, it should all be undertaken at once, completed as soon as possible in the first season and carefully maintained in constant repair thereafter until thoroughly established.

On the Ausable Watershed, the worst gully is that on Lot 9, Concession X of Williams East Township. It

The mouth of the gully where it enters the Ausable River is now 50 feet deep and 160 feet across. It started from a drainage furrow ploughed in the field in 1906.

The head of the gully temporarily stabilized by a concrete flume. Riprap and ground cover are required to complete the job.

A side gully eating its way back into the field because no adequate flume has been provided to carry the water from the tile outlet to the bottom of the gully.



Large trees should be removed from the brink of the gully because when they are thrown by wind they tear out a large mass of the bank.

runs in a southerly direction toward the Ausable River and is said to have been started by the ploughing of a furrow to drain water from the township road and adjacent fields in 1906. Today, this gully is about 1,000 feet long, 50 feet deep and 160 feet wide at the mouth. Several tile drains lead water into the sides of this gully, and as no provision has been made for leading the water down to the bottom, very severe erosion is taking place in branch gullies.

In 1927, the township constructed a concrete catch basin at the head of the gully, which proved ineffective and was washed out. In 1929, a sloping concrete flume was built which has served to arrest cut-back at the head of the gully to date, but this is badly in need of ground cover protection at the sides. No attempt has been made to arrest cut-back on the side gullies and these are advancing apace, cutting deeply into the fields drained by the tile.

This gully would make an excellent experimental and demonstration area in which to show how gully erosion can best be overcome and it is recommended that the Authority acquire the north half of Lot 9, Concession X of Williams East Township, with the object of arresting the progress of the gully and setting up a permanent demonstration of gully stabilization and reclamation.

A typical gully caused by accelerated run off, tile drainage with no protection of the outlet and removal of the natural cover of trees.

The same gully showing the mechanical features of erosion control, namely concrete flume with aprons at the top and bottom protected by rip rap on the sides and small check dams. Ground cover of trees, shrubs, vines and plants <u>must</u> be established on the slopes.

Profile of the same gully from A to B showing the position of the mechanical features — flume (d) aprons (e) and check dams (c).

GULLY EROSION AND CONTROL

FORESTRY

CHAPTER 1

THE FOREST

1. At the Time of Settlement

Because the Ausable is not a large river and does not lie on the routes followed by the fur traders, its watershed remained unexplored until the nineteenth century. The sand dunes which cut the river off from Lake Huron and the great swampy area behind them surrounding the former Lake Burwell presented such a formidable appearance from Lake Huron that the river was used only by Indians as a short cut to the Thames and apparently only by them at certain seasons of the year. The earliest description of the lower portion of the river, and the forest near it, was written by a Lieutenant Willson of the Royal Engineers[1].

"I was not able to extend my survey further from the obstacles in the river. The number of fallen trees and the quantity of drift timber being such as to prevent the passage of any canoe.......I followed the course of the river on foot, for about ten miles to see if the impediment diminished, but the whole of the distance except here and there for 100 yards was choaked up in the same manner." Apparently the river brought down great quantities of driftwood each year which were deposited in the sluggish channel between Grand Bend and Port Franks.

"Where it enters the lake, the country presents nothing but a cluster of sand hills with very little or no vegetation of any sort to be seen on their surfaces.....after you get up the river about a mile the land begins to be thinly covered with wood, pine intermingled with small oaks... Along the lake shore about half a mile beyond the Indian portage (Grand Bend) the clay approaches the surface and in a very short distance the sand is converted into rich, loamy soil and the timber from pines and small oaks thinly scattered

[1]Letter from Lt. Willson, R.E. to Col. Durnford - 1819.

Lombardy poplars sprouting from branches wash-up on the shore are common along some stretches of the beach.

In some sections the moving dunes kill trees already established.

Common Juniper Red Cedar and weather-beaten Red Pines are the only species able to withstand the battering of the winds.

Where the winds are not too strong and the dunes are not too steep White Cedar maintains itself along the shore.

changed into a thick forest of all those sorts of wood which indicate a luxuriant soil - proceeding up the river from the portage in about a mile the land on each side of the river begins to show marks of being inundated every spring, it is here about four feet above the level of the water in summer and shews evident signs of being overflowed to a depth of between two or three feet in the woods which are here full of heavy timber."

Eight years later a Dr. Dunlop[1] made a survey for the Canada Company and describes the forest farther inland. "The small brooks which do not arise from the large swamps have their origin generally from small cedar swamps or black ash swales." He describes four kinds of swamp -- white cedar, black ash, spruce (which occurs only rarely, he says) and mixed swamps usually of cedar and black ash. He says "The black ash swale -- wet in the spring and autumn but probably dry at midsummer -- has rich, deep soil" and that the ash is generally mixed with some soft maple and other trees. The main forest cover is described as mixed hardwood, with sugar maple the principal growth followed by beech, elm and basswood. Sometimes, but not often, there was more beech than maple. Hemlock predominated near the streams and interspersed all through were cherry, butternut, various species of oaks and birch. Pine was rare.

The relation of the original forest to the soil is outlined by a writer in 1831.[2] "The nature of the soil may be invariably discovered by the description of the timber it bears. Thus, on what is called hard timbered land where the maple, beech, black birch, ash, cherry, lime, elm, oak, black walnut, butternut, hickory, plane and tulip tree, etc., are

---

[1]Dr. Wm. Dunlop - Survey made for the Canada Company, 1827.

[2]Hints on Emigration to Upper Canada (Huron Tract) 1831.

found, the soil consists of deep black loam. Where fir, hemlock and pine are intermixed in any considerable portion with other trees, clay predominates; but where they grow alone, which is generally on elevated situations, sand prevails. This also happens where oak and chesnut (sic) are the only trees."

These early descriptions along with the vestiges of the primeval forest which remain to-day enable us to form a fair picture of what the original forest was like. The Ausable Watershed lies within the Deciduous Forest Region, that is the forest was composed almost entirely of broad-leaved trees and the distribution of these was controlled by climatic differences and the physiographic features of the countryside.

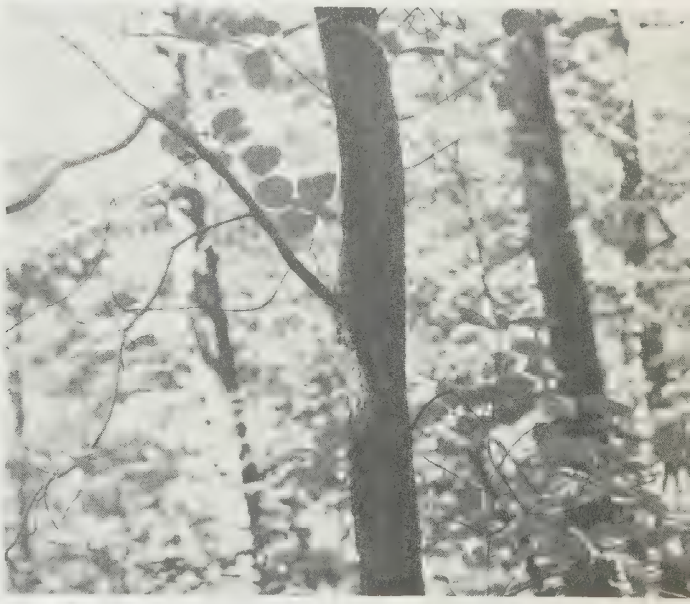
The physiographic features, in general, parallel the channel of the Ausable River itself, that is they run in a north-south direction in the northern part of the watershed and swing south-west and west in the southern part.

Stretching along the Lake Huron shore from Grand Bend to Port Frank , a distance of ten miles, are the sand dunes on which the famous "Pinery" stood. From the lake these dunes have probably presented the same appearance as they do to-day for thousands of years, with a sparse covering of trees stunted and deformed by a constant battle with the north-west winds sweeping across Lake Huron. The winds not only distorted their growth but moved the soil round their roots, piling it up in some places and excavating it in others. Only common juniper, red cedar, red pine and balsam poplar were able to survive at all.

Behind the first range of dunes pines both red and white found conditions to their liking and nearly the whole of this sand area was covered with pine. The site favoured red pine so there was considerably more of this

Dwarf Chestnut Oak is a dwarf tree or shrub growing abundantly in the Pinery and reaching its northern limit at Grand Bend.

Hackberry also occurs fairly frequently on bottomlands particularly toward the south end of the watershed.



Flowering Dogwood is fairly plentiful in the Ausable Valley east of Arkona but was not observed elsewhere in the watershed.

Chestnut Oak occurs sparingly in the Pinery where it probably reaches the northern limit of its range.

species and mixed with the pine was a good deal of stunted oak of various species which grew but was not able to produce commercial timber because the soil was unsuited to its best development. In the moist depressions between the dunes near Port Franks, silver maple-white elm swamps occurred and white cedar stands were also present between the dunes. Apart from the pinery white pine grew on the sandy soils, along the Ausable Valley and as occasional trees throughout the hardwood bush.

Behind the sand dunes was the swampy lagoon surrounding Lake Burwell which served as a flood plain for the Ausable River and the bush in this region was largely silver maple -white elm with some black ash and cottonwood. These swamp types also grew on the poorly-drained soils of the glacial spillways, while the wettest soils of these spillways supported tamarack and white cedar swamps. The till moraines and till plains which comprise most of the watershed were covered with the hardwood sugar maple -beech forest with hickory, black walnut, black cherry and numerous other southern hardwood species intermixed. Sycamore and hackberry occurred commonly throughout the river valleys and the less common southern hardwoods including tulip tree, chestnut, chestnut oak, sassafrass and flowering dogwood reached the southern part of the watershed.

2. Since Settlement

The attitude of the settlers to the forest was naturally antagonistic, first of all because it sheltered the hostile Indians and second because the trees stood in the way of all their efforts of improvement and the great task of removing them must be accomplished before any new development, whether it be constructing a road[1], clearing a farm or establishing a town site, could be undertaken. This inimical view of the forest, along with the idea that the

---

[1]The cost of clearing and stumping the two main roads through the watershed was about $1,300 per mile.

supply of timber was inexhaustible, was so firmly established that it is only in recent years that it has begun to disappear.

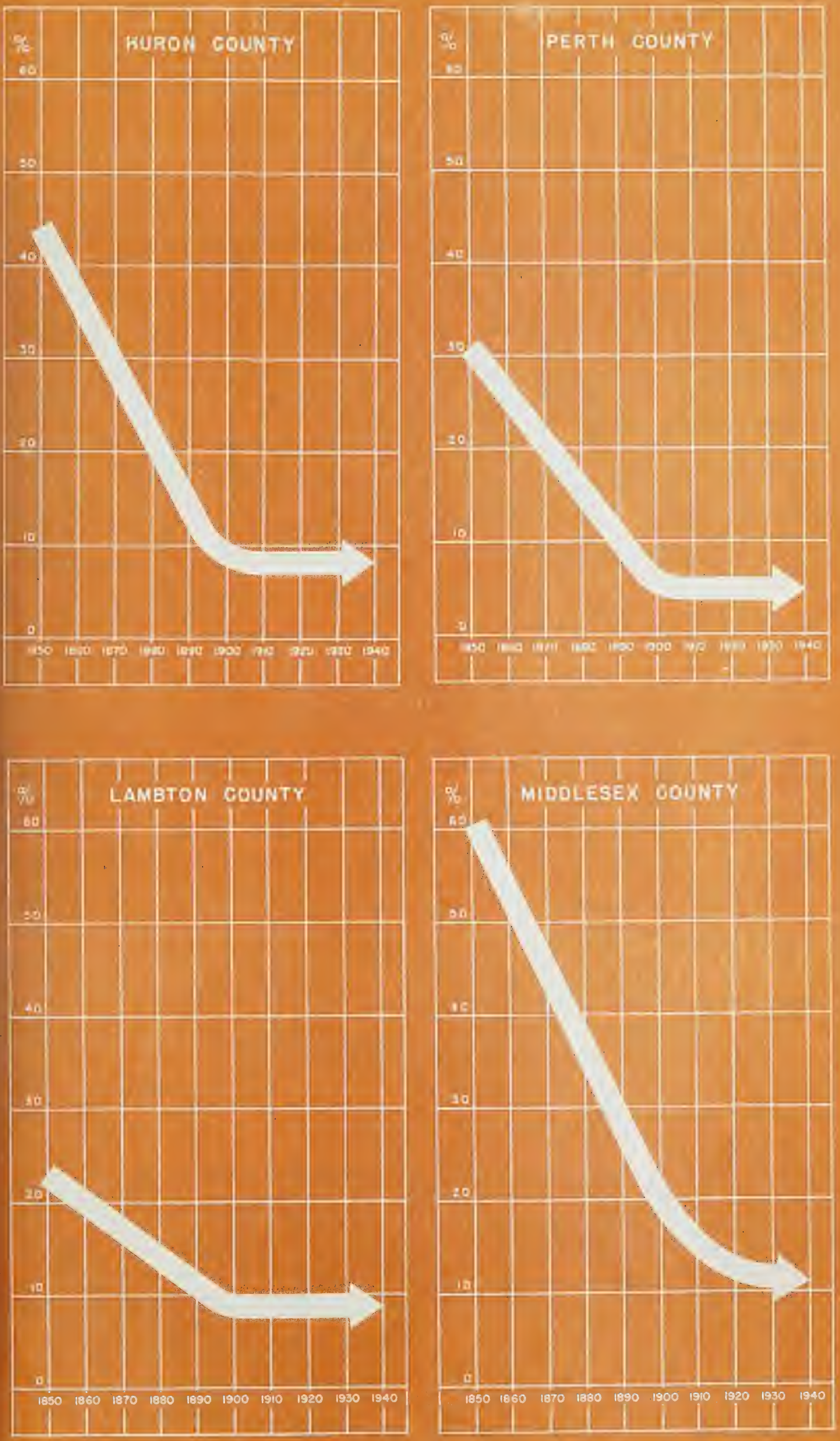
Lumbering did not play the prominent part in the settlement of the Ausable Watershed that it did on most other watersheds in Southern Ontario for several reasons. First, there was very little pine, second it was difficult to get out (it was almost impossible to "drive" hardwoods on the river) and third, the Canada Company which owned and sold the Huron Tract covering most of the watershed did its best to establish and maintain a monopoly over saw milling.

Most of the land in the Ausable Watershed is of high agricultural value and was largely covered with hardwood trees for which there was very little market[1]. When a new area was opened for settlement the best land was naturally taken first and the rough and swampy areas were avoided. Land was usually cleared first along the fronts of the farms and the woodland cut further and further back toward the end of the farm which lay farthest from the road. This was done, in many cases, without reference to the quality of the soil except where it was swampy and the consequence is that, to-day, the majority of woodlots lie at the backs of the farms between the concessions. This is particularly noticeable in Hibbert, Williams East and West, and McGillivray Townships.

The land bordering swamps was eventually taken up, the swamps were partially drained so that the edges became dry enough for partial cultivation, the forest was pushed back and in many cases completely cleared from areas which became covered with sedge grasses which have little or no value for pasture. A good example of this is the Hay Swamp.

---

[1] The only commodity which found a local sale in cash was a sort of potash called 'black salts' which was made by boiling down the lye extracted from the ashes made in burning the log heaps while clearing land. Topographical and Historical Atlas of the County of Middlesex. 1878.



PER CENT WOODLAND

CENSUS OF CANADA FIGURES

WOODLAND IN PER CENT AND ACRES

CENSUS OF CANADA FIGURES

TOWNSHIP	TOWNSHIP AREA	1850		1860		1910		1920		1930		1940	
		PER CENT	ACRES	PER CENT	ACRES	PER CENT	ACRES	PER CENT	ACRES	PER CENT	ACRES	PER CENT	ACRES
HAY	52,353	27.2	14,226	37.7	19,722	4.9	2,565	6.2	3,257	7.6	3,971	6.5	3,390
STEPHEN	56,697	16.7	9,470	27.4	15,573	8.6	4,861	5.9	3,360	9.5	5,421	6.9	3,940
TUCKERSMITH	40,659	54.8	22,336	43.6	17,740	7.7	3,154	6.8	2,774	6.8	2,784	6.2	2,514
USBORNE	43,016	43.3	18,690	50.8	21,864	6.5	2,796	6.0	2,581	6.0	2,587	6.0	2,560
TOTALS	192,725		64,722		74,899		13,376		11,972		14,763		12,404
BOSANQUET	58,933	28.9	17,325	33.1	19,835	7.3	4,378	9.9	5,939	10.6	6,391	9.5	5,679
WARWICK	64,111	32.1	20,586	49.7	31,870	11.7	7,514	10.3	6,632	11.5	7,379	9.4	6,045
TOTALS	123,044		37,911		51,705		11,892		12,571		13,770		11,724
ADELAIDE	44,433	49.7	22,048	48.6	21,590	8.2	3,632	7.9	3,505	7.8	3,383	7.2	3,196
BIDDULPH	39,401	62.2	24,515	51.9	20,417	5.7	2,252	5.1	2,000	6.2	2,431	3.4	1,337
LOBO	46,972	55.0	25,811	50.0	23,531	9.7	4,577	8.3	3,904	7.9	3,715	8.5	4,007
LONDON	94,687	56.4	53,383	46.2	43,740	5.6	5,268	6.8	6,431	6.8	6,448	6.4	6,025
McGILLIVRAY	66,910	33.7	22,457	41.7	27,949	6.8	4,652	11.1	7,456	9.2	6,132	7.0	4,703
WILLIAMS E.[1]	38,510	47.6	35,814	56.4	21,769	12.3	4,763	10.3	3,993	11.4	4,389	10.3	3,970
WILLIAMS W.	36,801	47.6		51.7	19,048	6.8	2,516	8.5	3,126	10.3	3,788	10.8	3,876
TOTALS	367,714		184,028		178,044		27,660		30,415		30,286		27,114
HIBBERT	41,869	44.2	18,503	55.2	23,124	8.7	3,631	8.0	3,349	7.8	3,276	6.7	2,787

[1]WILLIAMS E. AND W. ARE COMBINED IN 1850.

MAPLE SYRUP PRODUCTION IN GALLONS

CENSUS OF CANADA FIGURES

YEAR	HURON	LAMBTON	MIDDLESEX	PERTH
1850	185,213	111,430	430,391	152,652
1860	531,817	210,897	737,086	319,220
1870	578,435	155,508	597,204	323,745
1880	30,760	44,565	153,955	13,917
1890	116,250	137,942	509,350	74,904
1900	143,862	199,349	615,133	142,699
1910	56,572	27,234	57,755	33,635
1920	18,778	8,359	16,279	9,823
1930	31,988	15,919	26,984	13,843
1940	11,825	10,086	18,194	7,590

FOR YEARS 1910 TO 1940 INCLUSIVE MORE SYRUP THAN SUGAR WAS PRODUCED BUT SUGAR FIGURES HAVE BEEN CONVERTED TO THEIR SYRUP EQUIVALENT AND ADDED TO THE FIGURES FOR SYRUP FOR PURPOSES OF COMPARISON WITH PREVIOUS FIGURES.

MAPLE SUGAR PRODUCTION

CENSUS OF CANADA FIGURES

COUNTY	1850	1860	1870	1880	1890	1900	1910		1920		1930		1940	
	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.	GALS.	LBS.	GALS.	LBS.	GALS.	LBS.	GALS.
HURON	120,268	345,336	375,607	19,974	75,487	93,417	13,210	36,129	1,639	16,254	1,105	30,286	650	10,824
LAMBTON	72,357	136,946	100,979	28,938	89,573	129,448	2,870	24,814	42	8,294	815	14,664	158	9,843
MIDDLESEX	279,475	478,627	387,795	99,971	330,747	399,437	6,001	48,513	1,446	14,052	820	25,721	1,859	15,331
PERTH	99,125	207,286	210,224	9,037	48,639	92,662	803	21,269	209	9,503	140	13,627	810	6,343

The rate of the reduction of the forests was very rapid for though a Talbot settler named Howay was lost for thirteen days in the bush after pursuing a bear too far from his clearing near the present south-west corner of Williams West Township[1] in 1822, by 1850 Williams West was 40 per cent cleared and by 1910 less than seven per cent of the township was wooded. The rapidity with which this and other townships of the watershed were stripped of their timber is clearly shown by the Census of Canada figures in the accompanying table and graph. The chief value of these figures lies in showing how rapidly the bush was cleared rather than in the actual acreages of bush remaining at the dates shown because the definition of woodland varied from person to person, for example one farmer might consider a certain cut-over area to be pasture while another would call it woodland, because considerable reproduction or young growth still remained. In Williams West Township the amount of woodland appears to have been increasing since 1910 due to the abandonment of pasture on the sand plains.

The actual measurement of the woodland area within the watershed made in 1947 shows a total of 49,234 acres or 11.6 per cent of the total area.

---

[1] Five Years' Residence in Canada - E.A. Talbot.

CHAPTER 2

FOREST PRODUCTS

1. Early Policy

Previous to 1826 the only persons authorized to cut timber on the public lands were the contractors for the Royal Navy, or those holding licenses from them, and there was great infringement on the regulation and much illicit trade, but in this year the first steps towards making the forest resources a source of revenue to the Province and "so securing to the public a share of the wealth drawn from the public domain", led to co-operation among the officials and the termination of the contractor's monopoly. "The inauguration of a system under which any one was at liberty to cut timber on the ungranted lands of the Ottawa lumber region on payment of a fixed scale of rates to the Crown", overcame in large part the annoyance of the people and authorities in the colony against the export of the sound Canadian timber for the British Navy.

2. Masting

The selection of mast timber was made by government agents who went through the forest blazing with a broad arrow -- which was the mark of the British Government. As late as 1827, when Peter Robinson was appointed Surveyor-General of His Majesty's Woods and Forests in the province of Upper Canada, he was instructed "to make a Survey of the Districts where there may be any considerable growth of Masting and other Timber fit for the use of His Majesty's Navy."

The mast and spar export to Britain was thriving in the '30's and '40's and it was continued intermittently as late as 1855. The British trade dropped off noticeably after 1854 and this may be attributed to the Reciprocity Treaty with the United States in that year, "securing the

free exchange of the natural products between Canada and the United States, including 'timber and lumber of all kinds, round, hewed, and sawed, manufactured in whole or in part'," and the building of railway connections with the United States border cities.

3. Squared Timber

The squared timber trade commenced, no doubt, somewhat later than the mast trade and was carried on simultaneously with it from the '30's.

Squared timber consisted of selecting large trees, mostly white pine, and squaring the best part into one long stick. In the earliest days of the industry the timbers were squared on all four sides to a fine "proud edge", but later when the best timber had been cut, they were squared with a rounded shoulder, or "wane", which was known as "waney timber". Such methods, of course, were wasteful since the finest grained wood was sacrificed in the operation, but this was the type of material called for by the British market.

The timbers were built into huge rafts, on which the lumberjacks built shanties and lived during the trip down to the timber coves at Quebec.

4. Saw Material

Due to the small amount of pine on the Ausable Watershed and the distance from the sea ports, no great quantities of timber went into the masting and square timber trades.

From 1800 on the cutting of timber had been one of the most important domestic businesses in most parts of Southern Ontario but was restricted on the Ausable for the reasons given.

In order to convert logs into boards the first method used was pit-sawing. This was sometimes done

on the bank of the river, as such procedure saved the necessity of digging a pit.

The more usual methods of pit-sawing appear to have been the digging of a pit or building of a platform with a simple but firm and strongly constructed framework. In either case the framework was made the right height for one man to stand underneath, while the other man stood above on the platform or astride the log. This hard method of sawing timber was laborious, and twenty-five boards were a heavy day's work for two men; the boards being nearly always one inch thick, with planks two inches, and the occasional flooring of one and a half inches in thickness.

The Canada Company established mills very early, but had a monopoly of milling, with all the economic evils concomitant upon such a situation. However, in 1840, there were only two mills in the Huron Tract which were not owned by the company[1]. In one instance, however, the Canada Company overreached itself in its desire to control milling. Two Americans, Brewster and Smart, had purchased 2335 acres of land, including three mill sites, in Bosanquet and Williams townships in 1835. Their mill just south of the present town of Grand Bend seems to have been in operation from 1832 on, since interest is charged on the purchase money from that year. The Canada Company, anxious to maintain its monopoly in lumber made a contract with Brewster and Smart in which they agreed to purchase their "entire output." The enterprising Americans immediately proceeded to Detroit, where they bought two more saws and hired two more crews; in a short time enormous quantities of hastily cut and finished pine and hardwood began to arrive at Goderich by raft. Lizars notes that thousands of feet of this were never sold, the lumber being of such poor quality that export was impossible, and the local market being too small. From the

---

[1] Lizars, Daniel, A Report on the Affairs and Influence of the Canada Company, submitted to the Governor-General, 1840.

FOREST PRODUCTS OF FARMS

CENSUS OF CANADA FIGURES

PERTH COUNTY

PRODUCT	SPECIES	UNIT	1870	1880	1890	1900	1910	1920	1930	1940
PULPWOOD		CORDS								10
TANBARK		CORDS	2,556	2,533	1,591	12	11			
LATHWOOD		CORDS	184	108	45					
MASTS & SPARS		NUMBER	30	507						
STAVES		THOUSANDS	405	1,921	35	9	74			
FENCE RAILS		NUMBER						10,223	29,769	
FENCE POSTS		NUMBER			45,845	4,965	580	5,815	5,149	
POLES		NUMBER					6	5	49	
RAILWAY TIES		NUMBER			646				100	
SQUARE TIMBER	ASH	CU. FT.				20,669	1,800			
	BIRCH	" "				886	1,000			
	ELM	" "			103,137	113,528	8,742			
	MAPLE	" "				36,224	39,478			
	OAK	" "	8,933	55,243	2,100	1,830				
	PINE	" "	16,241	47,687	52,815	2,350				
	OTHERS	" "				43,060	8,474			
	TOTAL	CU. FT.	25,174	102,930	158,052	218,547	59,494			
LOGS (LUMBER)		NUMBER						17,147	462M	
LOGS SOFTWOOD	PINE	CU. FT.	61,112	154,017	15,423	162M				
	OTHERS	" "	35,187	197,527	51,180					
	SPRUCE	" "				5M	3M			
LOGS HARDWOOD	TAMARACK	" "	7,388	6,530						
	OAK	" "				66M	75M			
	MAPLE AND BIRCH	" "	5,806	7,611	2,505					
	ELM	" "	103,902	174,632		2,209M	1,647M			
	BLACK WALNUT	" "	160	525						
	BUTTERNUT	" "		131						
	HICKORY	" "	530	100	45	5M	1M			
	OTHERS	" "	170,342	330,998	40,375	611M	284M			
	HEMLOCK	" "				200M	32M			
	TOTAL	CU. FT.	384,517	872,071	109,528	3,258	2,042			
FUELWOOD		CORDS	115,030	134,429	95,499	96,568	44,470	56,244	35,952	27,127
OTHER PRODUCTS		VALUE $						772	740	10,590

FOREST PRODUCTS OF FARMS

CENSUS OF CANADA FIGURES

MIDDLESEX COUNTY

PRODUCT	SPECIES	UNIT	1870	1880	1890	1900	1910	1920	1930	1940
PULPWOOD		CORDS			12					
TANBARK		CORDS	412	322	668	29				
LATHWOOD		CORDS	285	1,984	50,164					
MASTS & SPARS		NUMBER	10	338		2	4			
STAVES		THOUSANDS	2,112	1,960	5,810	3,627	923			
FENCE RAILS		NUMBER						21,542	845	
FENCE POSTS		NUMBER			84,253	20,100	4,891	18,531	13,426	
POLES		NUMBER			118	264	225	501	110	
RAILWAY TIES		NUMBER			21,429			321	150	
SQUARE TIMBER	ASH	CU. FT.				9,153	2,220			
	BIRCH	" "				120				
	ELM	" "			88,561	137,709	85,036			
	MAPLE	" "				12,652	9,295			
	OAK	" "	272,041	481,727	32,146	12,855	5,042			
	PINE	" "	7,378	31,740	7,920	220	300			
	OTHERS	" "				12,747	6,040			
	TOTAL	CU. FT.	279,419	513,467	128,627	185,456	107,933			
LOGS (LUMBER)		NUMBER						39,516	956M	
LOGS SOFTWOOD	PINE	CU. FT.	16,452	22,322	81,790	341M	446M			
	OTHERS	" "	35,295	130,624	129,193					
	SPRUCE	" "				13M	2M			
LOGS HARDWOOD	TAMARACK	" "	37,598	36,765	3,160					
	OAK	" "				499M	373M			
	MAPLE AND BIRCH	" "	8,520	13,021	15,440					
	ELM	" "	299,782	215,968		10,028M	1,765M			
	BLACK WALNUT	" "	7,582	2,968	1,042					
	BUTTERNUT	" "	13,440	295,928	800					
	HICKORY	" "	19,040	42,022	15,201	119M	24M			
	OTHERS	" "	221,104	287,115	150,611	2,766M	3,085M			
	HEMLOCK	" "				102M	27M			
	TOTAL	CU. FT.	658,813	1,046,733	397,237	13,868M	5,722			
FUELWOOD		CORDS	256,712	267,756	233,266	182,878	95,113	112,923	78,790	47,230
OTHER PRODUCTS		VALUE $						482	672	23,618

M = M BD. FT.

IT IS IMPOSSIBLE TO CONVERT BD. FT. TO CU. FT. EXCEPT BY THE INDIVIDUAL LOG BUT AN APPROXIMATION MAY BE OBTAINED BY DIVIDING BD. FT. FIGURES BY 12.

records of the company, it appears that the two operators made something like £4000 out of this contract in 1835 before the Canada Company could terminate its disastrous bargain. In 1860 the Brewsters' dam was dynamited and the mill burned but a new mill had been built by 1868 and a mill was also in operation at Port Frank.

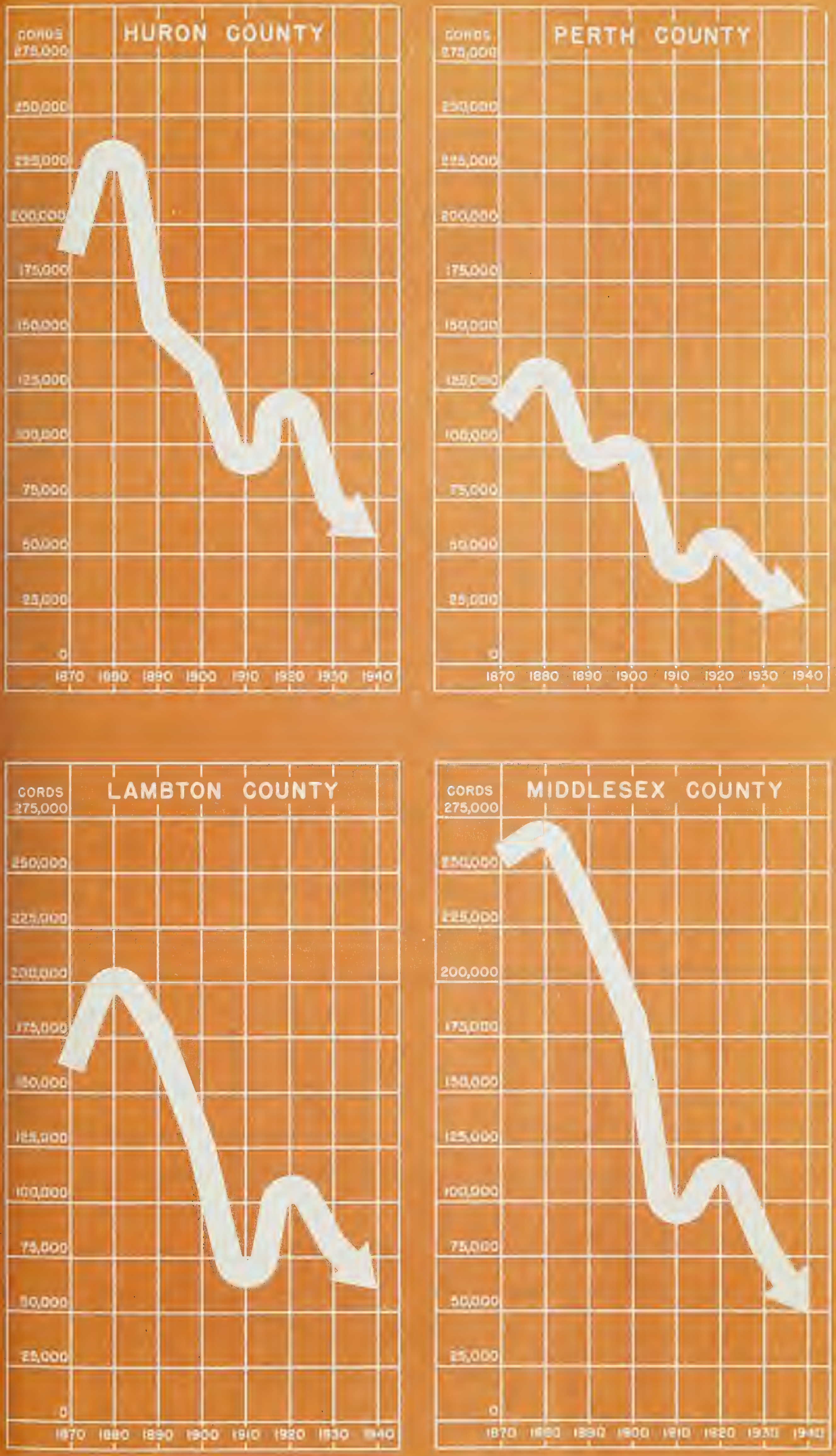
A saw mill was established near the site of the present village of Nairn by 1834 and steam mills were in operation at Sylvan in Williams West township and at Lucan by 1855. In 1879 William McConnell established a saw and grist mill where the London Road crosses the Ausable.

After the slow start outlined above, lumbering expanded greatly in the sixties and reached its peak about 1890. Wood products of all descriptions were shipped out to meet the demands of the Michigan furniture factories as well as those of Central Ontario, but by 1900 the trade had declined to small dimensions.

A study of the Census of Canada returns of forest products as given in the table reveals the various trends and changes in the lumber industry fairly clearly.

From 1870 to 1890 much of the timber was squared and measured in cubic feet, logs were merely counted. In 1870 other products listed were pulpwood, firewood, staves, lathwood, tanbark and masts and spars. Between 1880 and 1890 the peak production of nearly all items was reached and squared oak alone in Middlesex County ran to nearly 500,000 cubic feet in 1880. In 1890 fence posts and telephone poles were added to the list of products as were railway ties. In the census years of 1900 and 1910 squared timber was still recorded in cubic feet and logs were measured in board feet; staves, lathwood, masts and spars, and tanbark disappeared from production.

In 1920 no squared timber is shown and even logs are no longer separated by species. The returns of the



FUELWOOD PRODUCTION

CENSUS OF CANADA FIGURES

latest census covering the year 1940 show only two products of the forest individually and the rest are all listed together as others valued at so many dollars. The one product which has persisted throughout the records is firewood which in Middlesex County has dropped from a peak of 267,756 cords in 1880 to 47,230 cords in 1940.

One or two interesting observations with regard to individual species may also be made. Tamarack was listed in very large quantities regularly until 1890 after which it no longer appears due to the depredations of the larch saw-fly which almost wiped it out at this time. The returns show that black walnut, butternut and hickory were abundant until 1890. White pine was, of course, the species most sought after. In 1870 and 1880, it and oak were the only two species which were squared, but as these species became scarce, ash, birch, elm and maple were made into square timber.

From the earliest days of settlement on the Ausable to 1850, wood was the sole source of fuel supply. All species were used for this purpose including beech and maple - although these were furniture woods as well. With the inception of steamship travel and later the railway, and steam-driven factories, the forests of the area were ruthlessly cut to feed industry.

In the very early days of the steamship, 1832, the Honourable Adam Fergusson writes: "Wood is furnished upon the St. Lawrence for one dollar, or five shillings per cord while upon the Hudson it now costs three times as much - A man may prepare two cords a day, but it is severe work, and the price, which is one dollar per cord, will do little more than compensate maintenance and labour -- and an ordinary steamboat consumes fifty or sixty cords, or about 7,000 cubic feet each trip (from Montreal to Quebec)". The price

of cordwood in 1825 was quoted at $2 a cord.

With the completion of the Grand Trunk between Stratford and Sarnia in the 1850's, locomotive requirements took large quantities of the best body hardwood, chiefly beech and maple.

5. Saw Mills

At the present time there are five saw mills and three planing mills in operation in the watershed as shown in the table and two just outside the watershed at Dashwood and Strathroy.

These mills vary in size from one with an annual output of two million board feet down to small mills with daily outputs of two thousand board feet. The cut in all cases is predominantly hardwood including hard maple, elm (white, red and rock), basswood, and oak (red, white and bur). One mill sawed 20,000 bd. ft. of tulip (whitewood) several years ago which came from the vicinity of Parkhill. Some pine and hemlock is sawn but most of the softwood required by the door and sash mills including pine, hemlock, spruce, cedar and B.C. fir is imported.

Very little custom sawing is done on the watershed, all local wood is purchased outright and some farmers are supplying mills at the rate of 500 to 3,000 bd. ft. a year on a selective logging basis.

6. Woodworking and Planing Mills

During the early years of settlement in the rural districts and communities house trim for exterior and interior was made by the same man who constructed the frame of the house. The custom up to the 'fifties at least, was for the carpenter to board with the family the winter before the new frame house was to be built and work all his timber into shape by hand, both for the exterior and interior use.

The early carpenter also made door and window

frames and all interior trim of the house by hand, and for all these products, pine was the usual type of timber chosen. It would seem that door-steps were one of the very few things for which oak was used in house building, at least up to the 'sixties. For example, an old-timer in the watershed is reported to have said, when asked if they used much oak in the early days, "No, we didn't need to. We had plenty of pine."

Generally, as time passed, the building trades became more differentiated, and more craftsmen settled on the watershed.

After the appearance of the planing mill in the 'fifties the end of the hand-made door and window frames was foreshadowed, and much of the general carpenter's work was taken over by mill or factory. For example, in the eighteen-sixties the planing mill business was well underway. At the present time there are three planing mills on the watershed, at Hensall, Exeter and Thedford.

7. Road Materials and Fencing

In the early days, the making of corduroy roads furnished another important wood use. The Indian trails had followed the ridges and natural conformation of the country, but when the "T-square" roads had been laid out in government offices, they followed the arbitrary lot and concession lines regardless of natural contours. Many of these roads were built through swamps and in these places corduroy construction was used. Many corduroy bridges and culverts were also placed over the river and its tributary streams.

The building of plank roads -- a form of highway in which the planks were laid crosswise and side by side-- was done in several parts of the province and the London Road itself was planked between 1840 and 1842.

Much wood was also used for fencing and for this cedar from the swamps was most common. The troublesome pine stump, also was used for this purpose in many parts of the province, although in very early times it seems that it was

left in the fields. Around 1900 the wire fence came into use generally and thereafter a fence-post industry was developed: these were cut as a rule to a standard length of eight feet, while the diameter varied greatly.

8. Wooden Implements and Vehicles

(a) Early Tools:

From the very early days, hickory was preferred for the making of axe-helves or handles, while for beams or ox-yokes beech was used extensively and, for the loop, ironwood would probably have been selected. Spike handles were made of rock elm, white ash, hickory or ironwood; the beetle-head (a mallet used for pounding hemp and flax) was also made of ash, elm, hickory or ironwood. The hardwoods growing on the watershed were used almost entirely for making handles of implements, whereas pine was preferred for all building operations.

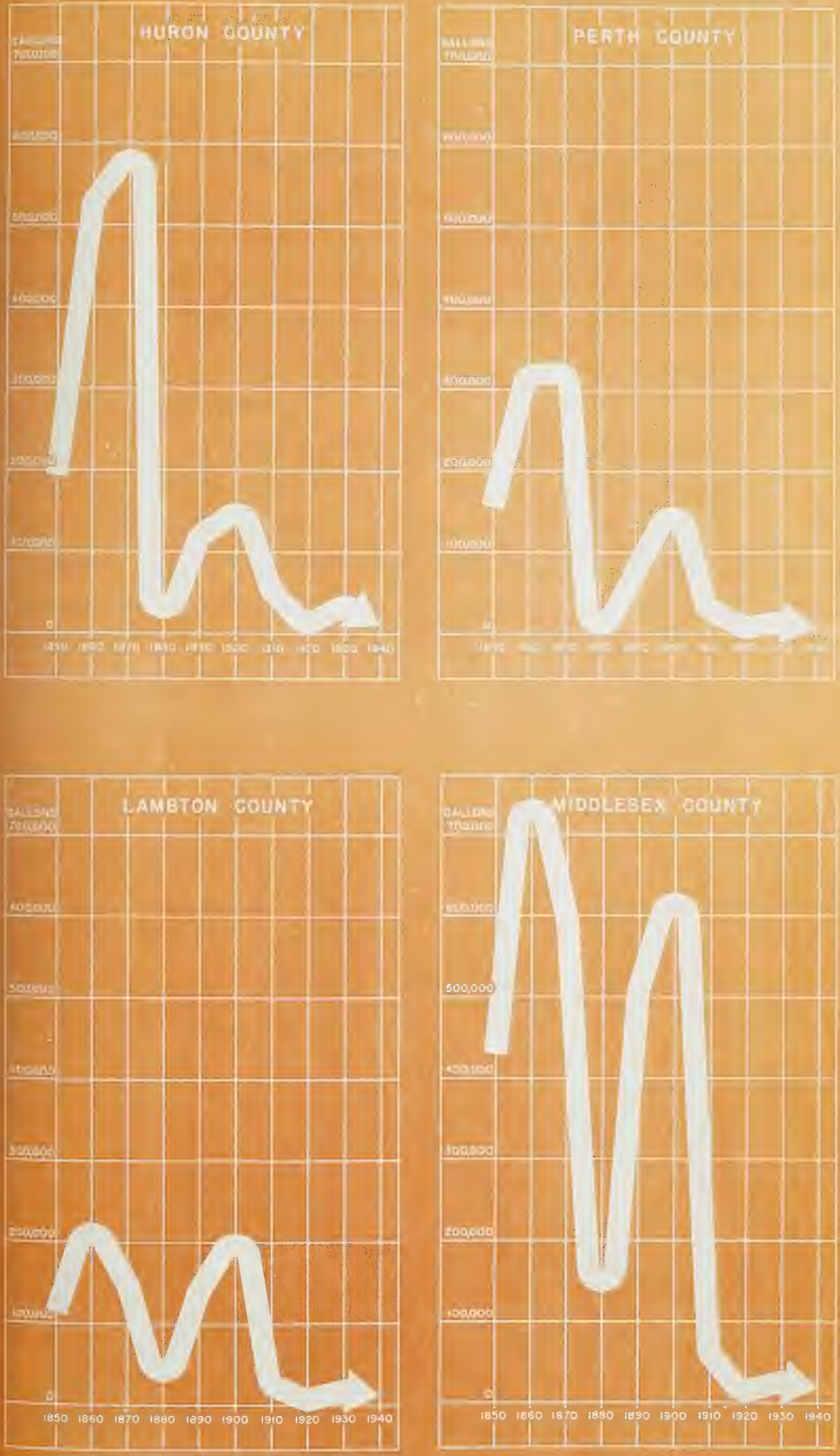
As settlement developed and more craftsmen arrived in the area, the general types of agricultural implements improved and metal replaced wood in large part.

(b) Vehicles:

From early times the making of vehicles progressed as carts, waggons, sleighs, and hay and wood racks were built by the farmers. In the building of carts and waggons, whiffletrees, waggon-tongues, and binding poles were made of rock elm, white ash, hickory and ironwood; as were also sleigh-runners and hay and wood racks. Usually the wheels or runners of these conveyances were bound with iron, or with tin, although the use of metal was limited in early days, since the supply had to be imported by water.

9. Indirect Products and By-Products

The three indirect products of greatest importance were maple sugar, lye and tanbark. Maple sugar furnished the staple sugar for the pioneers -- cane sugar not, at that time, having been procurable, lye, or potash, was used domestically in making soft soap -- almost the universal soap;



MAPLE SYRUP PRODUCTION

CENSUS OF CANADA FIGURES

tanbark was utilized in dressing leather by the shoemakers.

(a) Potash:

The ashery played an important role in the drama of pioneering life; and besides communal asheries, the individual ash house and the ash barrel on a platform for leaching was a characteristic of each farm in the days before the soap manufactory came into being. In 1871, 171 barrels of potash were shipped from Goderich.

(b) Maple Sugar:

The first table shows the Census of Canada figures for maple products in the counties of the watershed. It is interesting to note that up to 1910 production is all recorded as pounds of sugar, from 1910 on both pounds of sugar and gallons of syrup were shown, indicating the change from a pioneer necessity to the modern luxury. For purposes of comparison the sugar figures have been converted to their syrup equivalents and from these, shown in the second table, it will be seen that production in all counties dropped steadily from the peak in 1890 to less than a twentieth of that year's production in 1940.

CHAPTER 3

PRESENT WOODLAND CONDITIONS

In order to get as accurate a picture as possible of woodland conditions in the Ausable Watershed a detailed study was made of all woodlands, natural water storage areas and plantable land by the forestry party.

1. Survey Methods

Each member of the forestry party was provided with aerial photographs which were on a scale of 1,000 feet to the inch and each photograph covered an area of approximately 1,000 acres, usually a block lying between two adjacent concession roads and two adjacent side roads.

Every area of woodland, brushland, marsh, swamp and rough land was visited and notes made describing it. In the case of woodlots and plantations, detailed notes were made of their condition. Overgrazed woodlots and woodlots with very scattered trees which could be restored were classified as woodland. In short, where doubt existed as to whether an area should be classified as woodland or not, woodland was given the benefit of the doubt.

All woodlots were grouped according to the Department of Land and Forests' classification as follows:

Mature	Hardwood	Mixed Wood	Coniferous
Virgin	H-1	M-1	C-1
Moderately culled	H-2	M-2	C-2
Severely culled	H-3	M-3	C-3
Immature			
Second growth	H-4	M-4	C-4
Young growth	H-5	M-5	C-5

In this classification the term "hardwood" is used to denote all broad-leaved trees irrespective of whether the wood is physically hard or not. A hardwood type is one in which 80 per cent or more of the stand is composed of hardwood trees, a coniferous type is one in which 80 per cent of the stand is composed of coniferous trees and a

mixed stand embraces all others.

Mature stands are those which have reached commercial maturity and are separated into three groups, namely, those which have had practically no cutting done in them which are termed virgin stands, those which have been moderately logged usually under some form of selective logging, and those which have been severely culled where, as a rule, only large defective trees remain. Immature stands are those in which the trees have not reached commercial maturity and these are subdivided into two groups, namely, that in which the trees are over four inches in diameter at breast height which are designated as second growth stands and that in which the trees are under four inches in diameter which are termed young growth.

Stands were also grouped according to forest cover types. (See accompanying table, the description of forest types, and map folded at the end of this report.)

Where plantations were encountered records were made of planting, care, damage and survival.

2. Forest Cover Types

The Ausable Watershed lies partly within the Deciduous Forest Region and partly with the Huron - Ontario section of the Great Lakes - St. Lawrence Forest Region.[1] The line separating these two regions follows approximately the course of the Ausable River itself from Grand Bend to Arkona and east to Nairn.

The south and western portion of the watershed enjoys a very favourable climate doubtless produced by the modifying influence of Lakes Huron and Erie. On the cultivated land peach orchards and vineyards are to be found. The forest associations are almost entirely hardwood and many species find their northern limit here including tulip tree, mockernut and pignut hickories, dwarf chestnut, chestnut and

---

1 A Forest Classification for Canada by W.E.D. Halliday, Dominion Forest Service Bulletin 89, 1937.

black oaks, sassafrass and flowering dogwood. Sweet chestnut also grew here before being exterminated by the Chinese Chestnut Blight. On the lighter soils are small areas of white pine, and red pine and red cedar occur on the sandy soils of "The Pinery".

By far the larger part of the watershed lies within the second forest region which is made up of widely distributed broad-leaved trees common in part to both regions. Sugar maple and beech are dominant comprising the greater part of the forest; with them are basswood, white elm, white ash, red maple and red, white and bur oaks. Yellow birch is found sparingly being close to the southern limit of its range. Small groups of hemlock and white pine occur as well as a scattered distribution of aspen, bitternut hickory, butternut and black cherry; blue beech, silver maple, slippery and rock elm and black ash are found locally on specialized sites such as river bottoms and swamps. In addition there are intrusions from the Deciduous region of sycamore, hackberry, swamp white oak and shagbark hickory.

In making the survey of the woodlots no attempt has been made to classify them according to forest types. Forest cover types only have been used and are defined as being[1] "a forest type now occupying the ground -- no implication being conveyed as to whether it is temporary or permanent."

A forest cover type may be either temporary or permanent, for example, the present stand may be aspen which has seeded in the area following fire. Aspen seed is light like dandelion seed and is carried easily by the wind, thus it quickly covers large areas, also it is not exacting in its soil requirements and may be the only species which

---

[1] Forest Cover Types of the Eastern United States - Report of the Committee on Forest Types, Society of American Foresters, 1940.

will grow under the soil conditions existing at the time. The fact of its growing and dropping its leaves on the ground gradually improves the condition of the soil so that more exacting species can grow. In addition its light shade frequently provides the correct light conditions for better species to get a start. As it is a short-lived tree, it will die early and the other species will dominate the area. This succession may be carried through two or more stages until the species best suited to the area or best able to maintain itself on the area takes over and this is called the forest type or climax type as distinguished from the forest cover type which is the type occupying the ground at the present time. One of the commonest forest types on the Ausable Watershed is silver maple - white elm.

No classification of forest cover types has been made in Canada for Southern Ontario so the system used is a slightly modified form of that drawn up by the Society of American Foresters which covers the whole of the eastern United States, consequently there are many types in their classification which do not enter Canada and this accounts for the gaps in the numerical listing of types occurring in the Ausable Watershed.

Because of the greater number of species occurring in the Ausable Watershed the number of forest cover types is larger than in most watersheds of Southern Ontario and they may be listed as follows:

Cover Type No.	Cover Type Name
3	Red Pine
4	Aspen
6	Paper birch
9	White pine
10	White pine - hemlock
11	Hemlock
12	Sugar maple - beech - yellow birch
13	Sugar maple - basswood
14	Sugar maple
14A	Black cherry
24	White cedar
25	Tamarack
26	Black ash - white elm - red maple

TOWNSHIP	TOTAL ACRES	3	4	6	9	10	11	12	13	14	14A	24	25
Adelaide	2,102		8						87	88			
Biddulph	1,080								76	28			
Blanshard	135								6	15			
Bosanquet	14,347	1,234	1,758	100	51	10		27	536	195		59	10
Hay	3,522		1,631				9		70	114		25	
Hibbert	1,436		9						13	328			
Lobo	1,102		15						32	94			
London	650								10	116			
McGillivray	7,496		170						322	807		11	
Stephen	4,960		574	22					298	401			
Tuckersmith	267								9	32			
Usborne	1,842								105	110	5		
Warwick	339		6							87			
Williams E.	4,731		94						108	364			
Williams W.	5,225		118		7		2	16	187	91		17	
Total Acres	49,234	1,234	4,383	122	58	10	11	43	1,859	2,870	5	112	10
Per Cent		2.5	8.9	0.2	0.1	0.0	0.0	0.1	3.8	5.8		0.2	

TOWNSHIP	TOTAL ACRES	26	45	46	49	51	57	58	59	60	60A	61	88
Adelaide	2,102		7			18	571	8	257	354	704		
Biddulph	1,080	6					357	3	98	246	246		20
Blanshard	135						52			43	17		2
Bosanquet	14,347	92		79	6,129	77	855	13	551	2,025	471	19	56
Hay	3,522						376	10	2	1,047	211		27
Hibbert	1,436						740		56	80	210		
Lobo	1,102						454	1	97	138	271		
London	650						217		81	114	112		
McGillivray	7,496	315				15	1,257	24	291	2,704	1,311		269
Stephen	4,960	30			84	69	714	12	68	1,857	792		39
Tuckersmith	267						115		12	44	55		
Usborne	1,842						820	4	71	523	188	9	7
Warwick	339						105		58	74	9		
Williams E.	4,731	23					1,356	6	243	2,117	413		7
Williams W.	5,225	144			59		2,677	44	64	1,270	501		28
Total Acres	49,234	610	7	79	6,372	179	10,666	125	1,949	12,636	5,511	28	455
Per Cent		1.2		0.2	12.8	0.4	21.6	0.3	4.0	25.7	11.2	0.1	0.9

Cover Type No.	Cover Type Name
45	Bur Oak
46	Red cedar
49	White oak - black oak - red oak
51	Red oak - basswood - white ash
57	Beech - sugar maple
58	Beech
59	Ash - hickory
60	Silver maple - white elm
60A	White elm
61	Cottonwood
88	Willow

Type 3 Red Pine

Red pine occurs in pure stands and in mixtures with white pine. White oak, red oak and black oak are associates while paper birch, gray birch and poplars are sometimes in mixture in young stands.

It occurs on sandy and gravelly locations, on shallow-soiled, rocky knolls and lake shores or on dry sandy loam soils.

In the Ausable Watershed it occurs only in "The Pinery" on sandy soil in pure stands and mixed with white pine or white, red and black oak. It forms 2.5 per cent of the woodland of the watershed.

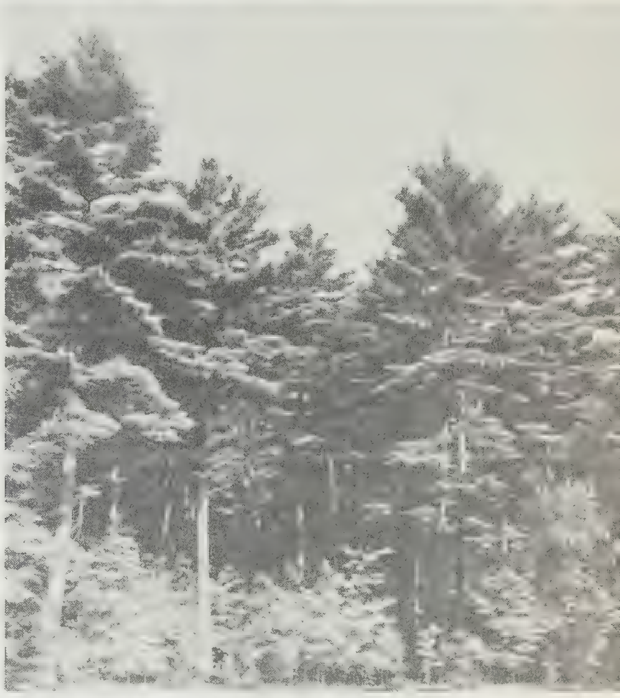
Type 4 Aspen

Aspen is a pioneer type coming in after fire or over-grazing. Though it avoids the wettest swamps, it does grow on soils that are wet throughout a good part of the year as well as on dry soils. Its associates may be white elm, paper birch, red cherry and balsam poplar with occasionally large-toothed aspen and green ash. It forms almost ten per cent of the woodland mostly on poorly drained, neglected pasture lands of sand, silt or muck soils.

Type 6 Paper Birch

This is also a pioneer type of clear cut and pastured areas succeeded by other northern hardwood types or white pine. Its associates include small proportions of aspen, white pine, hemlock, red maple, red oak and basswood. Frequently an understory of conifers or tolerant hardwood develops.

Aspen also grows on wet sands such as the neglected pasture land of the Hay Swamp. It serves as a nurse crop for better species.



Type 9-White pine has an abundant type in the Pinery and occurred on the light soils bordering the Ausable Valley. Today only fifty-eight acres remain.

Type 57-Beech, sugar maple was undoubtedly the most extensive type covering most of the best agricultural land. It still makes twenty-two per cent of the woodland. This is a mature (H2) stand.

Type 3-Red pine at one time covered most of the Pinery but did not occur elsewhere in the watershed.

It comprises a fraction of one per cent of the woodland.

Type 9 White Pine

The associates of this type on light soils are aspen, red maple, red cherry, white ash, red oak, sugar maple, basswood and hemlock. It was never abundant in the watershed and the original stands were rapidly consumed for local use. It now occupies about fifty-eight acres in all, most of which is in "The Pinery".

Type 10 White Pine - Hemlock

Associated with this type are many species but none is particularly characteristic. The principal ones are beech, sugar maple, basswood, red maple, yellow birch, black cherry, white ash, paper birch and red oak. It occurs on a range of sites from sand plains to heavy upland soils, but favours cool locations such as the slopes of ravines. It is almost negligible in the Asuable Watershed.

Type 11 Hemlock

This type occurs mostly in widely scattered bodies in cool locations, moist ravines and north slopes frequently in the sugar maple - beech type. Its associates are beech, sugar maple, yellow birch, basswood, red maple, black cherry, white ash, white pine, paper birch and red oak. A very few acres are present on the Ausable area.

Type 12 Sugar Maple - Beech - Yellow Birch

The associates of this type are basswood, red maple, hemlock, red oak, white ash, white pine, balsam fir, black cherry, paper birch and white elm. Though it is a common type somewhat further north it is rather insignificant in the Ausable Watershed which is near the southern limit of the range of yellow birch. It occurs on well-drained, loam soils and frequently gives place to the beech - sugar maple type.

Type 13 Sugar Maple - Basswood

This is a fairly important type occurring on

loamy, upland soils. Its associates are white elm, green ash, yellow birch, white pine and red oak with ironwood and blue beech as subordinates. It forms almost 4 per cent of the woodland of the watershed.

Type 14 Sugar Maple

Sugar maple as a pure type was probably never extensive in the watershed. The beech - sugar maple type 57 covered much greater areas and may have been converted to type 14 in some instances by farmers removing the beech for fuel and leaving the maple for sugar. Yellow birch, white ash and red oak may be present. It constitutes about 6 per cent of the wooded area.

Type 14A Black Cherry

This is an uncommon type which occurs only in small areas in Southern Ontario usually on fertile, moist, well-drained soils, frequently those occupied by almost pure stands of hemlock following cutting of the latter. Only a very few acres occur in this watershed.

Type 24 White Cedar

The associates of this type are tamarack, yellow birch, paper birch, black ash, red maple, white pine and hemlock. It occurs on sites of slow drainage which are not strongly acid, including the muck soils of the watershed and is also present on poor pasture land and bottomland. It forms only a small fraction of one per cent of the woodland but should be planted extensively on wet sites throughout the watershed to provide fence posts and poles.

Type 25 Tamarack

Tamarack occurs in muck swamps with little or no drainage associated with white cedar and less commonly with red maple, black ash and aspen. The trees are small and have grown since the near extinction of the species in the early part of the century. Considerable areas originally

Type 24-White cedar occupied glacial drainage channels where poorly drained soils existed and muck areas. It has been almost exterminated but cedar should be extensively planted because of its value for posts and poles.

Type 46-Red cedar occurs only on the sand dunes adjacent to Lake Huron in the Pinery. Because of its small size in Ontario it is of little commercial value.

This is a second growth stand (H4) of beech-sugar maple type.

Type 49-White oak, black oak, red oak covers most of the Pinery today because of its ability to fight fire. The quality of timber is poor but the oak would provide considerable revenue as fuelwood under a forest management programme.

existed in the Hay Swamp and the glacial drainage channel east of Exeter but only ten acres remain to-day and this is in the swamp region near Port Franks.

Type 26 Black Ash - White Elm - Red Maple

This type occupies moist to wet soils in swamps, gullies and small depressions. Its associates are balsam poplar, yellow birch with sometimes white pine, tamarack, white cedar, basswood and bur oak. It comprises about one per cent of the woodland.

Type 45 Bur Oak

This is a very uncommon type in Ontario, the associates of which are red oak, white oak or black oak, and occurs on loamy slopes with south or south-west exposure. Only 7 acres are present on the Ausable Watershed.

Type 46 Red Cedar

Red cedar normally occurs on limestone soils or dry uplands associated with white oak and white elm or red maple and aspen. In the Ausable Watershed it is found only on the sand dunes bordering Lake Huron in "The Pinery". It is the type closest to the lake, the trees are never large but form the outer bulwark of tree growth against the constant battering of the winds sweeping across Lake Huron.

Type 49 White Oak - Black Oak - Red Oak

White oak, black oak and red oak predominate usually with a small admixture of a number of other species including bur oak, shagbark or bitternut hickory, white or green ash, sugar maple and occasionally a few black cherry, butternut or large-toothed aspen. In "The Pinery" dwarf chestnut oak is common. It usually occurs on loamy, well-drained soils but also on morainal and deltate slopes. In most regions it appears to give place to sugar maple types but in "The Pinery" it seems to be the established climax which is increasing in area due to frequent fires gradually

eliminating the pine. This type forms almost 13 per cent of the woodland of the watershed.

Type 51 Red Oak - Basswood - White Ash

Associated with the species are red maple, yellow birch, aspen, sugar maple, paper birch and beech on less well-drained soils. This is not an important type there being only 179 acres in the watershed.

Type 57 Beech - Sugar Maple

This is regarded as the typical association of the climax with red maple, white oak, red oak, hemlock, white elm, red elm, basswood, shagbark hickory and black cherry. This type was undoubtedly the most extensive of any in the Ausable Watershed but, because it occupied the best land, its area has been tremendously depleted and it now comprises about 22 per cent of the remaining woodland. It occurs on nearly all the well-drained soils of the area.

Type 58 Beech

Theoretically this is the ultimate dominant of the climax but is almost invariably associated with sugar maple and to-day forms less than one per cent of the woods. Its other associates are red maple, red oak, white ash, white elm, red elm and bitternut hickory. It occurs on the same well-drained soils as the beech - sugar maple type.

Type 59 Ash - Hickory

This type is not listed in the American classification but has been introduced because of its frequent occurrence in or near the Deciduous Region. It is usually a residual type following cutting often of type 60 silver maple - elm, though it may occur on any poorly-drained, cut over area. It is usually composed of a mixture of white, green or red ash and shagbark and bitternut hickory with bur and swamp white oak, cottonwood, blue beech and ironwood as associates. It constitutes almost 4 per cent of the woodland.

Type 60 Silver Maple - White Elm

This is a type of flood plains and poorly - drained soils unsuitable for general farming unless completely and adequately underdrained; for this reason it, and the similar white elm type 60A have survived better than forest cover types on better drained land. Associated species are red maple, slippery elm, cottonwood, white, red and green ash, swamp white and bur oak and bitternut hickory. This type represents nearly 26 per cent of the woodland of the watershed.

Type 60A White Elm

Type 60A is very similar to the silver maple - white elm type 60, but is found on drier sites as well as swamps and swales and its associated species are the same. It is not listed in the American classification but has been introduced here because of its frequent occurrence in Southern Ontario. It comprises over eleven per cent of the woodland so that these two types together make up thirty-seven per cent of the total woods in the watershed.

Type 61 Cottonwood

This type is not common. The species is usually mixed in the two preceding types but almost pure stands do occur. The chief associates are white or green ash, white or slippery elm, silver and red maple. It represents a small fraction of one per cent of the woodland.

Type 88 Willow

Several species are included in this type but the commonest is black willow. It occurs on wet sites but in relatively small areas and comprises about one per cent of the woodland.

The large map shows the distribution of these types throughout the watershed and from it the following observations may be made:

1. With the exception of red pine type 3 in "The Pinery" coniferous types are almost non existent in the watershed.

2. Elm swamp types which covered large areas around former Lake Burwell, near Port Franks and in the glacial drainage channels have survived pretty well throughout the watershed.

3. Cedar and tamarack swamps which were scattered throughout the area have virtually disappeared through cutting, draining and pasturing.

4. Sugar maple types are found generally throughout the watershed with the largest areas in Williams East and West, McGillivray and Bosanquet Townships.

5. Oak types occur almost exclusively in "The Pinery" constituting large areas but due to the poor, sandy soil the trees are of poor form and in general of little value except as firewood.

6. The chief pioneer type following cutting and pasturing is aspen type 4 which covers fairly large areas of poorly drained soil particularly in Bosanquet, Hay and Stephen Townships.

3. Present Conditions

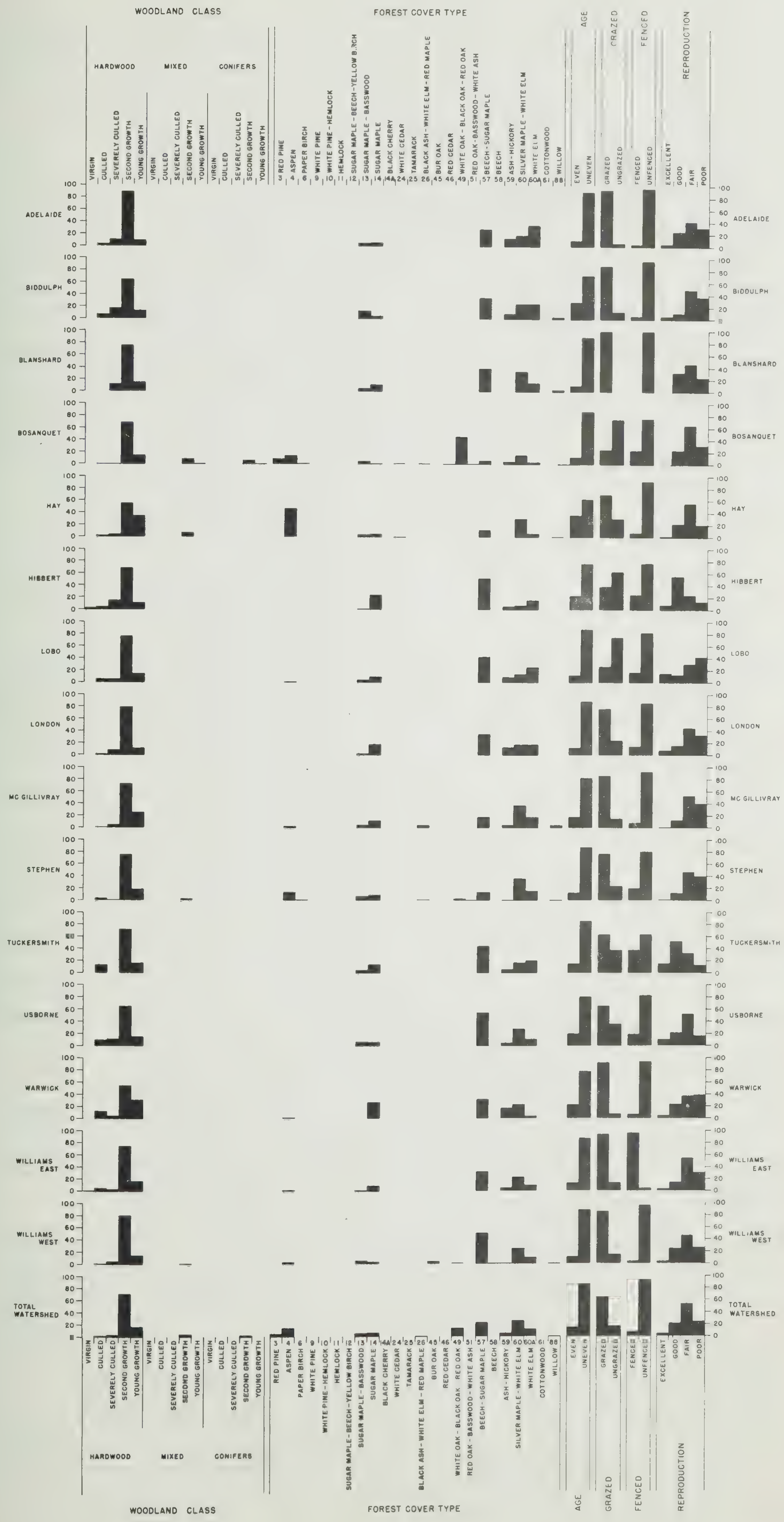
The results of the forest surveys are summarized in the accompanying table.

Woodland within the watershed comprises 49,234 acres which is 11.7 per cent of the total area of 425,971 acres drained by the Ausable River and its tributaries. The total number of woodlots examined was 3,002 which includes many areas which are considered by their owners as constituting a single woodlot but which, because of the difference in types and age classes of certain sections, had to be considered in the field as separate units. Conversely, where property boundaries were not marked as in "The Pinery" and the Lake Smith areas, woodland extending across two or more

WOODLOT CONDITIONS

TOWNSHIP	AREA OF WOODLANDS	AGED		GRAZED		FENCED		REPRODUCTION			
		EVEN	UNEVEN	YES	NO	YES	NO	A	B	C	D
ADELAIDE	2,102	213	1,889	1,955	147	74	2,028	76	502	868	656
BIDDULPH	1,080	303	777	945	135	54	1,026	42	113	533	392
BLANSHARD	135	13	122	135			135		42	62	31
BOSANQUET	14,347	1,764	12,583	3,565	10,782	347	14,000	143	3,318	9,257	1,629
HAY	3,522	1,314	2,208	2,446	1,076	294	3,228	64	782	1,973	703
HIBBERT	1,436	326	1,110	556	880	332	1,104	117	795	340	184
LOBO	1,102	128	974	816	286	195	907	166	141	336	459
LONDON	650	72	578	493	157	90	560	54	105	286	205
McGILLIVRAY	7,496	1,357	6,139	6,392	1,104	602	6,894	94	1,096	3,617	2,689
STEPHEN	4,960	588	4,372	3,862	1,098	1,004	3,956	40	612	2,310	1,998
TUCKERSMITH	267	41	226	165	102	102	165	39	124	72	32
USBORNE	1,842	374	1,468	1,179	663	343	1,499	181	394	941	326
WARWICK	339	76	263	311	28	25	314	10	74	125	130
WILLIAMS E.	4,731	639	4,092	4,393	338	176	4,555	141	656	2,495	1,439
WILLIAMS W.	5,225	581	4,644	4,477	748	182	5,043	206	1,247	2,426	1,352
TOTALS	49,234	7,789	41,445	31,690	17,544	3,820	45,414	1,373	9,995	25,641	12,225
PER CENT		15.8	84.2	64.4	35.6	7.8	92.2	2.8	20.3	52.1	24.8

WOODLAND CONDITIONS BY TOWNSHIPS
1947



properties was often considered as a unit because the type and age class remained constant throughout.

The conifers occurring in the watershed are Red pine, white pine, hemlock, white cedar, tamarack and red cedar. Red pine and red cedar are confined to "The Pinery", the latter as a very small tree. White Pine is fairly generally scattered throughout "The Pinery" and occurs very sparingly further inland. Hemlock is found mixed with hardwoods throughout the watershed and white cedar and tamarack are present in some of the swamps. There is no doubt that conifers, though never abundant, formed a larger part of the woodland than they do to-day. But their numbers have been diminished because of the desirability of the lumber they furnish and in the Pinery recurrent fires have destroyed them while more fire resistant species such as oak have survived. The situation at the present time is that of the 49,234 acres of woodland 95 per cent is classified as pure hardwoods, 3 per cent as mixed woods and 2 per cent is classified as pure conifers. Of the hardwoods 6 per cent is virgin hardwoods which have been moderately or severely culled. Of the remainder 71 per cent is second growth approaching commercial size and 18 per cent is young growth under four inches in diameter at breast height.

In the mixed wood classes all the woodland is of the young growth class while the coniferous woods are nearly all second growth stands.

For the whole area the percentage of uneven-aged stands is considerably more than the even-aged, the figures being 84 per cent of the former and 16 per cent of the latter.

Grazing in farm woodlots is very general, the percentage of grazed woodland to ungrazed being 64 per cent for the whole watershed, which figure would be considerably

TOWNSHIP	NO. OF WOOD-LOTS	AREA IN ACRES	WOODLOT CLASS											
			H1	H2	H3	H4	H5	M1	M2	M3	M4	M5	C4	C5
ADELAIDE	150	2,102		53	200	1,662	187							
BIDDULPH	178	1,080		64	194	688	134							
BLANSHARD	11	135			15	100	20							
BOSANQUET	424	14,347		84	81	9,935	2,080				1,306	61	699	101
HAY	201	3,522		61	128	1,897	1,226	7	2		199		2	
HIBBERT	118	1,436	22	49	212	994	159							
LOBO	144	1,102		57	59	828	158							
LONDON	74	650		6	61	510	73							
McGILLIVRAY	426	7,496		94	273	5,293	1,825						11	
STEPHEN	253	4,960		143	40	3,745	948				84			
TUCKERSMITH	23	267		35		190	42							
USBORNE	250	1,842		170	198	1,185	285			4				
WARWICK	40	339		42	9	182	106							
WILLIAMS E.	316	4,731	38	219	158	3,524	792							
WILLIAMS W.	394	5,225		60	221	4,169	734				39		2	
TOTAL ACRES	3,002	49,234	60	1,137	1,849	34,914	8,757	7	2	4	1,628	61	714	101
PER CENT			0.1	2.3	3.8	70.9	17.8	0.0	0.0	0.0	3.3	0.1	1.5	0.2

H-HARDWOOD- 80% or more of the main stand composed of hardwoods.

C-CONIFEROUS- 80% or more of the main stand composed of conifers

M-MIXED- All other stands.

MATURE-

Stands which have reached commercial maturity.

SECOND GROWTH-

Stands approaching maturity and varying in age from about 25 years for fast growing species on good sites to 70 years for slow growing species on poor sites.

YOUNG GROWTH-

Stands with maximum diameter breast high not exceeding 4 inches.

MATURE:

Virgin	H-1, C-1, M-1
Moderately Culled	H-2, C-2, M-2
Severely Culled	H-3, C-3, M-3

IMMATURE:

Second Growth	H-4, C-4, M-4
Young Growth	H-5, C-5, M-5

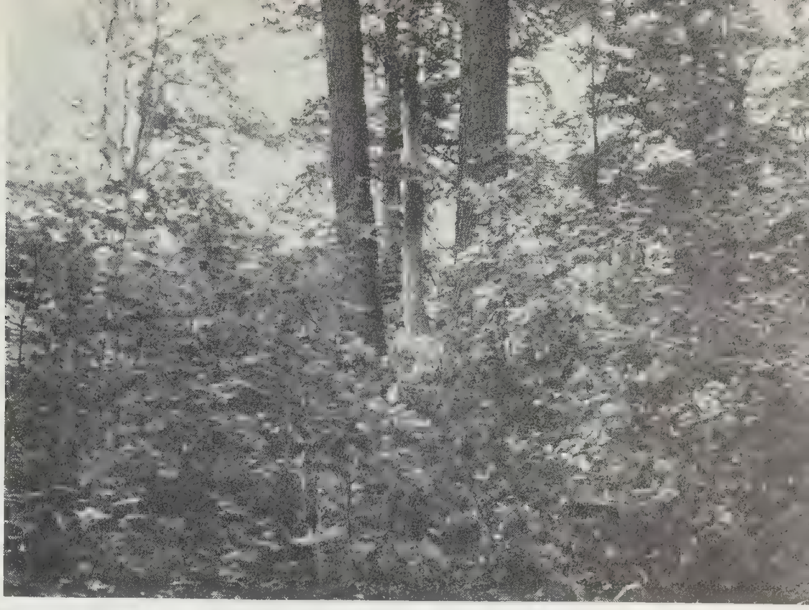
higher if it were not for the Pinery in Bosanquet Township which is ungrazed. This is an indication of the low value which the average landowner places on his woodland as a permanent crop. Grazing, as is well known, is detrimental to the proper development of any area. The number of cattle and the size of the woodlot have a direct relationship to the damage which is done. For example, a large woodlot is not as seriously affected by a few head of cattle as a small one, but on most farms the woodlot is small and is seriously damaged by large herds. Grazing in a woodlot destroys young growth, open areas appear and become covered with grass, which means that the maintenance of the forest floor, which is so important to the health of the stand, is interfered with and there is less likelihood of a renewing of the stand by reseeding from old trees. These in turn become stag-headed and are easily preyed upon by fungus and disease.

Fire is not a serious factor menacing woodlands in the watershed except in The Pinery and the peat area around Smith Lake. Here it is a very serious factor in the form of surface fires which take their almost annual toll of young growth and regeneration particularly of coniferous species. It is not necessary to burn a tree to kill it, merely raising the temperature of the growing layer inside the bark to 150 degrees Fahrenheit will do the job and this is frequently what happens. The oaks have particularly hard, fire-resistant bark and have survived better than the pines while red pine which has a more resistant bark than white pine has survived better than white pine.

Fire protection is an absolute essential for the proper management of woodland in The Pinery and the adjacent Lake Smith area. It is recommended that when the Ausable Forest is established, fire-fighting equipment and sufficient personnel be provided to patrol the forest and fight

EXISTING WOODLAND

ONE TREE REPRESENTS FIVE HUNDRED ACRES OF WOODLAND



Natural regeneration of maple and beech in tremendous numbers takes place when selective logging is practiced and cattle are excluded from the woodlot.

In many parts of the Pinery sufficient seed trees remain to reforest the area naturally if fire is kept out and would be aided by the removal of the oak.

On the peat soils adjacent to Smith Lake fire converts the area which once bore trees into the dense tangle of scrub willow and alder.

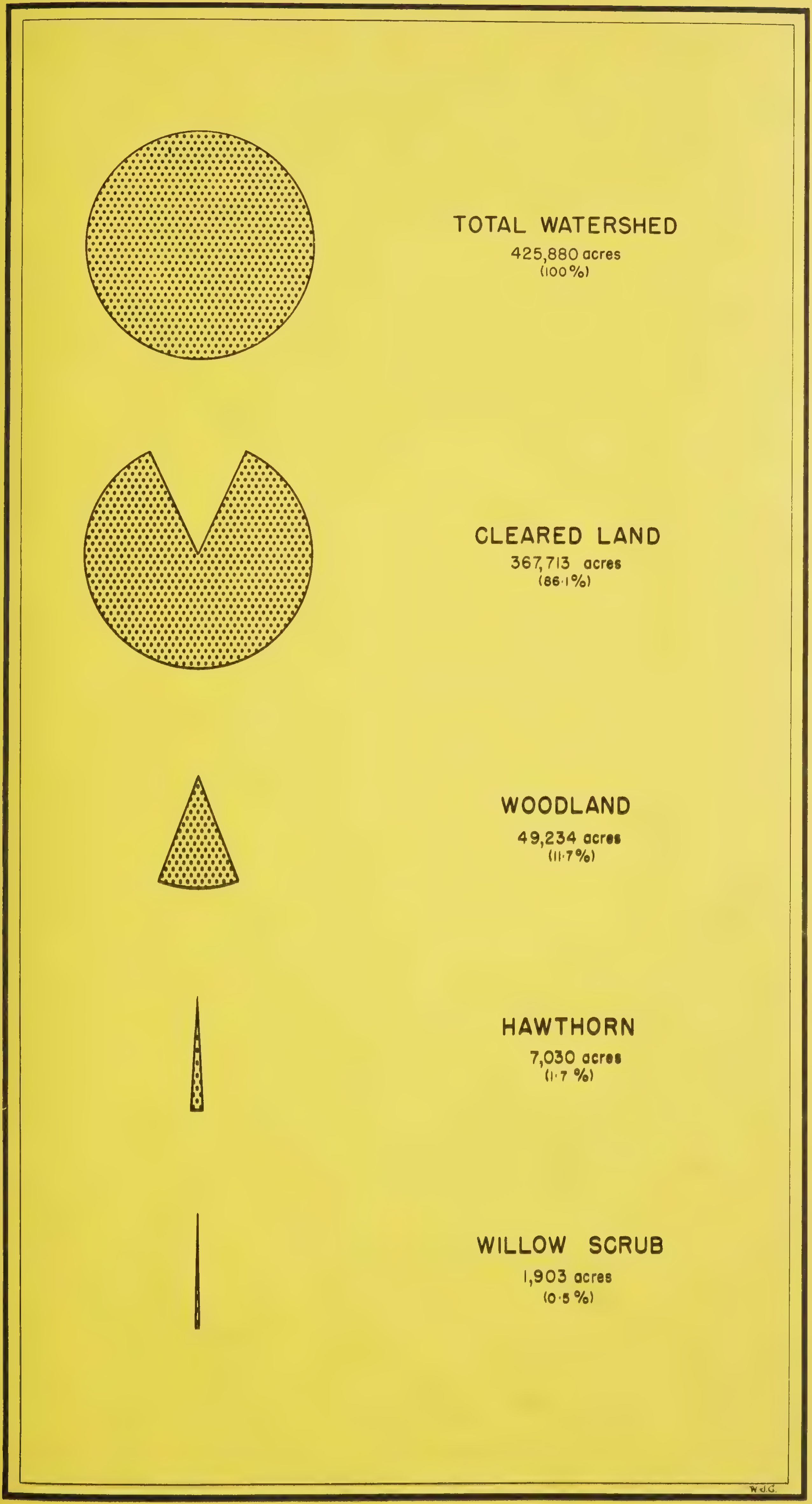
Red pine will reproduce itself abundantly when protected from fire.

fire when it occurs anywhere in the watershed.

Due to the prevalent custom of grazing in the woodlots many stands have become open and require some planting. Of the areas examined 25 per cent are devoid of natural regeneration and require some planting to bring them back to fully stocked stands.

Because the Ausable Watershed is made up largely of long established, prosperous farming communities, clear-cutting which has ruined so much woodland in other parts of Ontario has not been generally practiced in recent years, and in most cases some form of selective logging has been carried out. Nearly 77 per cent of the woods are second growth stands which range from thirty to fifty feet in height with fairly extensive areas of sapling stands and some areas containing trees up to eighty and ninety feet in height. The few lots containing the largest trees are composed of old hardwoods, elm and soft maple in the swamp areas, and sugar maple, beech and basswood on dry sites.

From the foregoing it will be seen that compared with the area of the watershed the wooded areas are not extensixe but they do aggregate nearly 50,000 acres and are worth preserving and improving. No systematic method has been used in the past, little effort has been made to combat fire in the vulnerable area of The Pinery and only 8 per cent of the woodland is fenced from cattle.



LAND CLASSIFICATION - TOTAL WATERSHED

CHAPTER 4

FOREST CONSERVATION MEASURES IN PROGRESS

A few fairly extensive areas of land exist throughout the watershed which are suitable only for the growing of trees. The largest of these is, of course, The Pinery in which the county of Lambton established a county forest of 630 acres in 1940. In addition there are areas of poorly drained land in the glacial drainage channels and submarginal land on the deltate sands and moraines.

1. Private Planting

The free distribution of trees for planting was first begun in Ontario in 1905, and the following year a statute was passed which enabled a township council to exempt a part of the woodland of a farm from taxation; it provided that:

"Any part of a farm used for forestry purposes or being 'Woodlands'; provided that such exemption shall not be greater than one acre in ten acres of such farm and not more than twenty acres held under a single ownership."

"'Woodlands' for the purpose of this paragraph shall mean lands having not less than four hundred trees per acre of all sizes, or three hundred trees, measuring over two inches in diameter, or two hundred, measuring over five inches in diameter (all such measurements to be taken at four and one-half feet from the ground) of one or more of the following kinds: White or Norway Pine, White or Norway Spruce, Hemlock, Tamarack, Oak, Ash, Elm, Hickory, Basswood, Tulip, (white wood); Black Cherry, Walnut, Butternut, Chestnut, Hard Maple, Soft Maple, Cedar, Sycamore, Beech, Black Locust, or Catalpa, or any other variety which may be designated by Order-in-Council, and which said lands have been set apart by the owner with the object solely, of fostering the growth of the trees thereon and which are not used for grazing livestock." R.S.O. 1927, c. 238, s. 4, para. 25; 1934, c. 1, s. 4 (3).

TREES FOR SCHOOLS[1]

YEAR	HURON	LAMBTON	MIDDLESEX	PERTH	TOTAL
1933	--	596	675	424	1,695
1934	1,782	400	1,735	2,050	5,967
1935	399	60	786	875	2,120
1936	--	305	675	—	980
1937	3,060	1,640	34,836	78,782	118,318
1938	355	1,590	1,970	53,262	57,177
1939	31,295	10,104	5,853	23,993	71,245
1940	4,882	1,789	1,385	74,191	82,247
1941	16,031	3,358	5,401	11,905	36,695
1942	1,986	4,700	4,254	13,825	24,765
1943	2,075	1,137	5,786	172,672	181,670
1944	124,108	2,815	6,280	77,634	210,837
1945	208,375	--	1,985	86,734	297,094
TOTAL	394,348	28,494	71,621	596,347	1,090,810

[1]DEPARTMENT OF LANDS AND FORESTS FIGURES

TREES DISTRIBUTED FOR PRIVATE PLANTING[1]

YEAR	HURON	LAMBTON	MIDDLESEX	PERTH	TOTAL
1905-1912	33,165	19,434	40,165	33,195	125,959
1913-1925	114,614	65,901	198,998	93,817	473,330
1926	78,702	35,938	114,998	61,522	291,160
1927	99,648	59,259	130,032	72,184	361,123
1928	85,598	52,665	161,082	95,747	395,092
1929	71,466	77,815	141,945	72,847	364,073
1930	118,482	80,415	214,326	111,312	524,535
1931	103,726	57,790	177,852	86,468	425,836
1932	162,234	79,666	306,721	85,589	634,210
1933	110,983	69,114	293,716	120,322	594,135
1934	14,367	83,089	212,736	88,839	399,031
1935	161,759	70,529	184,554	103,548	520,390
1936	163,224	143,690	316,103	105,687	728,704
1937	165,635	217,842	362,258	126,281	872,016
1938	196,930	139,831	272,920	83,590	693,271
1939	319,984	231,807	340,528	223,054	1,115,373
1940	272,157	222,045	327,733	121,971	943,906
1941	156,731	245,055	229,369	100,990	732,145
1942	235,276	79,354	341,579	98,430	754,639
1943	163,981	262,917	238,957	97,783	763,638
1944	124,048	417,351	217,729	42,683	801,811
1945	60,097	98,180	211,208	53,757	423,242
TOTAL	3,012,807	2,809,687	5,035,509	2,079,616	12,937,619

[1]DEPARTMENT OF LANDS AND FORESTS FIGURES

ACRES OF PRIVATE PLANTATIONS

WITHIN THE AUSABLE WATERSHED

	ADELAIDE	BOSANQUET	HAY	LONDON	McGILLIVRAY	STEPHEN	USBORNE	WILLIAMS EAST	WILLIAMS WEST	TOTAL
CONIFERS	1	7	12	1	25	16		6	6	74
HARDWOOD	1	1				36	6			44
TOTALS	2	8	12	1	25	52	6	6	6	118

In 1927 the exemption of taxation on woodland was made compulsory if applied for, and is interpreted as meaning planted as well as natural trees.

In 1938 the Assessment Act was amended to prevent assessment being raised on land after it had been reforested and now reads as follows:

"Land which has been planted for forestation or reforestation purposes shall not be assessed at a greater value by reason only of such planting." -- The Statute Law Amendment Act, 1928, C. 37, s. 2 (1).

Both these Acts were designed to facilitate the planting of trees on private land and should be taken advantage of by citizens anxious to improve woodland conditions on their own property, and at the same time benefit the whole community of the river valley.

For some years now, the Department of Lands and Forests has divided Southern Ontario into zones, each with its "Zone Forester" whose duty it is to give advice and assistance to private individuals and municipalities on the management of their woodlands and the establishment of plantations. There are two zones covering the Ausable Watershed, the first of which includes Huron and Perth Counties with the zone office at Stratford and the other covering Lambton and Middlesex Counties with the office at Chatham. At the present time, the zones are far too large for one man to cover adequately. It is anticipated that in the near future these zones will be subdivided so that each forester will have a much smaller area to cover. This will mean that the forester will have more time to devote to the establishment of county forests, demonstration and school plots and also more time to help individuals with their woodlot and reforestation problems.

The nearest forest tree nursery to the Ausable

Watershed is that at St. Williams in Norfolk County which was established in 1908 and has served as the largest production and distribution centre for trees ever since. To-day, forty years later, the Norfolk Provincial Forest Station of 3,800 acres presents a magnificent young forest of pine and other species. This station also maintains a small sawmill, in which thinnings from improvement cuttings are being manufactured into materials for local use. Thousands of visitors go to this beauty spot and a small park is provided for their accommodation. Many officials of municipal and other organizations from all parts of the province have visited this place and returned convinced that all waste areas of the province should be reforested and so made useful and beautiful.

The table shows the total numbers of trees distributed for planting on private land in the counties lying partly within the Ausable Watershed since the provincial government first began to distribute trees for this purpose in 1905. The total number of trees is given as 12,937,619 but it is difficult to estimate how many were actually planted within the watershed. However, on the basis of area an estimate of two million might be made.

The total acreage of private plantations of over one acre in extent which exist within the watershed to-day is 118 which would require at six by six foot spacing 142,780 trees. If we take into consideration the fact that large numbers of the 2,000,000 trees would be used for replacing losses on established plantations, for planting open areas in existing woodlots and for the establishment of windbreaks and shelterbelts, it is still apparent that a large number have been lost through various causes chief among which are lack of protection from cattle, planting on soils unsuited to the species used and to lack of care of young plantations to eliminate competition from weeds and weed shrubs, which

A jack pine plantation 20 years old on a gravelly glacial beach near Liuery. All gravel areas such as this on private land should be planted with trees.

A corner of the small Lambton County Forest where red pine trees have been planted mostly under the native oaks.

A plantation of hardwoods 19 years old on the property of the Hon. Duncan MacArthur near Grand Bend.

A red and Scotch pine plantation near Port Franks.

smothered the small trees before they were properly established.

It is therefore recommended that a much closer check be made of what happens to trees distributed for private planting in future and that periodic inspection of plantations be instituted.

2. <u>County Forests</u>

In 1922 the present policy of county forests was laid down. This work is done under the authority of The Municipal Reforestation Act (R.S.O. Chap. 323), which lay dormant from 1911 until the above year. The Act provides for the purchasing of land and the entering into agreements by the county for the management of such lands. No limit as to the size of the area is stated so that some counties have plots of a few acres, while others have forests of several thousand acres. If, however, a county wishes to enter into an agreement with the Minister of Lands and Forests for the planting and management of such county-owned land, the policy has been that the county must purchase not less than one thousand acres. The agreements which are in force at the present time run for a period of thirty years, during which time the Ontario government agrees to establish the forest, and pay the cost of such items as fencing, buildings, equipment, labour, maintenance, trees, etc., in short, everything connected with the management of the forest.

At the end of the thirty-year period, the county has the privilege of exercising one of three options: <u>First</u>, to take the forest over from the Government and pay back the cost of establishment and maintenance; <u>Second</u>, to relinquish all claim to the forest, whereupon the Government will pay to the county the cost of the land, without interest; <u>Third</u>, the forest may be carried on as a joint undertaking by the province and the county, each sharing half of the cost and half the profits.

It will be seen from the above summary of the agreement that all a county stands to lose on such a project is the interest for thirty years on the purchase price of the land. Also, it should be pointed out that, in drawing up such a liberal scheme, it was done purposely to encourage the reforestation of land not suited to agriculture. Again, it was not the intention of the Government to have the counties stop at a minimum of 1,000 acres as the overhead necessary on an area of this size could very easily be spread over an area of five, or even ten times, the size. As a matter of fact this is what happened in some counties where the councils have initiated a progressive reforestation policy.

This Act has recently been amended so that municipal councils of townships shall have all the powers, privileges and authority conferred on councils of counties except that instead of issuing debentures to an amount not exceeding $25,000.00, they shall have power to levy, by special rate, a sum not exceeding $1,000.00 in any year, for the purpose of providing for the purchase of land for planting and protecting the timber thereon. -- The Municipal Reforestation Amendment Act. S.O. 1946, Ch. 62.

The agreement which has recently been drawn up between the Ganaraska Authority and the Ontario Government to establish and manage the Ganaraska Forest is substantially the same as that made with the counties except that the government has agreed to pay half the cost of the land and the agreement for planting and management is to run until the year 2,000 A.D.

Lambton County is the only one which has made the beginnings of a county forest in the watershed, though Huron County has purchased 460 acres for this purpose near Goderich. In 1940 Lambton County acquired 630 acres of land at the south end of "The Pinery" lying mostly south-west of

the road into the village of Port Franks. About 93,000 trees have been planted largely as underplantings beneath the over-cover of oak which has taken over most of "The Pinery" following cutting of the coniferous trees and the subsequent repeated fires. No full-time caretaker has been provided for this forest nor has any fire protection system been established. This last is of particular importance in this region because of the very large number of tourists and cottagers who visit the area during the summer months and the increased fire risk which is created by their presence at this time of year.

3. Municipal Forests

In addition to the large blocks of land recommended for inclusion in the Ausable Forest are many smaller areas of several hundred acres in extent on privately owned property. These are areas which cannot profitably be used for agriculture and where they occupy whole farms or are important from the standpoint of the public good, such as the protection of headwaters of streams, they should be the concern of the county or township councils.

Assistance with regard to the establishment of Municipal Forests and the supplying of free trees is still the policy of the Department of Lands and Forests. Moreover, as provided by the amendment to the Counties' Reforestation Act, it is possible for a township council to enter into an agreement with private landowners for the reforestation of their property.

The amendment permits the council of a township to enter into agreements with the owners of land providing for the reforestation of portions of such lands. The agreements will prescribe the cutting conditions of all trees planted and such conditions will be subject to the approval of the Minister of Lands and Forests.

"Provision is also made for exempting such

lands from taxation and for making arrangements with the Dominion and Provincial Ministers of Labour regarding conditions of labour and payment of wages in connection with planting and conservation of such areas." -- The Municipal Reforestation Act, S. O. 1945, Ch. 14.

No municipal forests have been established in the watershed and in view of the fact that areas of potential forest land exist which are at present non-productive municipalities are urged to establish forests of this type.

Before leaving the subject of municipally-owned forests and forests which provide the local communities with at least a part of their livelihood, it would be as well to review what is being done along these lines in other places.

In Nova Scotia there is a community living on Hammonds Plains near Halifax which depends entirely on wood taken from small woodlands for its livelihood. In this settlement the largest woodlot is not over 400 acres in extent and because of the rocky nature of the soil the people are not able to augment their incomes by farming, though most families own a cow, a pig and some chickens. The wood from the woodlots is manufactured into barrels and boxes by more than twenty small mills which are largely family owned and operated. The people are thrifty and industrious; they have comfortable homes, are public-spirited and extremely forest fire conscious. This is a community which has developed naturally and yet resembles communities based on a forest economy which have been planned and established in Europe for a considerable time.

One of the most recent is the forest of Ae in Dumfriesshire, Scotland. It was established by the British Forestry Commission in 1927 and covers an area of 10,683 acres of which 3,000 acres has been planted, 4,500 acres is scheduled for planting in the near future, 250 acres of the best land has been set aside for cultivation and the balance of 2,800

acres is unplantable because of its altitude but is used for sheep pasture in summer.

The forest is in charge of a forester who resides on the spot and under him there are foremen and gangs of workers. In the first year sixteen men were employed, just before the war twenty-seven full-time employees were engaged, and by 1960 about ninety men will be needed the year round for essential forest work. This does not take into account temporary employees who will be required for saw milling, transport and other jobs. It is planned to create a forest village for the workers embodying a church, a school, playgrounds and sportsfields. The combination of the forest and the village dependent on it is something new in Scotland and represents an important stage in the resettling of men and women in the country. The village is to be the forerunner of other similar villages and in many parts existing villages will be revitalized by the stimulus of forest wealth.

4. Demonstration Plantations

No demonstration plantations have been set out within the watershed. The value of these in showing land owners what can be accomplished by planting trees in a very few years is so great that every township should endeavour to establish at least one plot.

In other watersheds these were established under the policy which was laid down by the government in 1922 when it offered to assist municipalities in the establishment of small forest plantations for the purpose of demonstrating the use of trees on marginal and sub-marginal land. The requirements are that it be on a well-travelled road and that the land be owned by the municipality, in return the government will supply the trees free. It is recommended that all the townships within the watershed establish plantations of this nature to serve as demonstrations in each community.

5. Demonstration Woodlots

Demonstration woodlots are privately owned areas of woodland on which the owners have agreed to follow prescribed methods of woodlot management outlined by the Department of Lands and Forests, under the zone forester and to permit access to the area by interested persons. Such demonstration woodlots and the influence they exert for the proper management of similar areas contribute to the total conservation effort in any watershed. Supervision of these during the war has been spasmodic at best and many have been seriously neglected. Within the Ausable Watershed five demonstration woodlots were established, one in each of Bosanquet, London, McGillivray, Warwich and Williams East Townships, varying from 10 to 45 acres in extent.

6. School Forests

In order to encourage the establishment of school forests which would be planted and cared for by school children the Ontario Horticultural Association organized an annual competition in 1945 for which prizes are offered for the school having the best plantations and knowledge of forestry in each forest district. Prizes are provided by the Ontario Conservation and Reforestation Association and by Mr. J. E. Carter of Guelph. The winners in these district competitions are eligible for the Provincial Forestry Competition for which Mr. Carter furnishes one hundred dollars in prizes. No schools within the watershed have participated in these competitions and no school plots exist within the watershed though eight plots were established in Huron County in 1946.

Trees have been sent out to schools in all four counties of the watershed but these have been distributed to children for planting on the home farm and many of these have been used to form windbreaks and shelterbelts. For this purpose the number of trees distributed by the Department of Lands and Forests is shown in the table.

CHAPTER 5

FOREST CONSERVATION MEASURES REQUIRED

1. Source Areas and Reforestation Land

The most important conservation measure required on the Ausable Watershed is the establishment of several forest areas to be called the Ausable Forest under the Conservation Authority, which will serve to cover the natural water storage areas of the river valley. The second most important conservation measure is the establishment of a fire control system under the authority which will be in a position to fight fire anywhere in the watershed, but particularly in the area known as "The Pinery".

Thirteen such areas have been defined as shown in the accompanying table with the acreages of woodland, willow scrub, hawthorn and open land in each. The page-size map shows the location of these areas and the main tributary streams to which they supply water. The names given to these areas are taken from nearby places. The large folded map at the end of this report gives more detail showing the present tree cover, willow scrub, hawthorn and open land within these areas. In addition the map shows woodland, willow scrub, sand blow holes, and glacial gravel beaches throughout the whole watershed. These indicate small areas on privately owned land which should be under tree cover; the controlled management of these small areas is discussed elsewhere in this report.

The total acreage recommended for acquisition as source areas and reforestation land is 37,513 acres of which 17,617 has some form of tree cover, 923 acres is overrun with hawthorn, 703 acres is willow scrub, and 18,270 acres is open land -- peat, sand or till moraine.

SOURCE AREAS AND REFORESTATION LAND

No.	Name	Woodland	Willow Scrub	Hawthorn	Open Land	Total
1	Hay Swamp	2,901	602	148	6,403	10,054
2	Harpley	566	11	--	2,023	2,600
3	Pinery	8,738	31	--	1,021	9,790
4	Smith Lake	1,829	42	--	2,590	4,461
5	River Bend	1,098	--	--	999	2,097
6	Arkona	1,105	--	--	1,051	2,156
7	McInnis	391	--	--	556	995
8	Parkhill	461	17	479	1,003	1,960
9	Bornish	132	--	19	649	800
10	Keyser	326	--	110	564	1,000
11	Ailsa Craig	16	--	--	384	400
12	Clandeboye	26	--	119	455	600
13	Staffa	28	--	--	572	600
		17,617	703	923	18,270	37,513

SOURCE AREAS
AND
REFORESTATION LAND

LEGEND

1. HAY SWAMP
2. HARPLEY
3. PINERY
4. SMITH LAKE
5. RIVER BEND
6. ARKONA
7. Mc INNIS
8. PARKHILL
9. BORNISH
10. KEYSER
11. AILSA CRAIG
12. CLANDEBOYE
13. STAFFA

SCALE : MILES

1 0 1 2 3 4 5

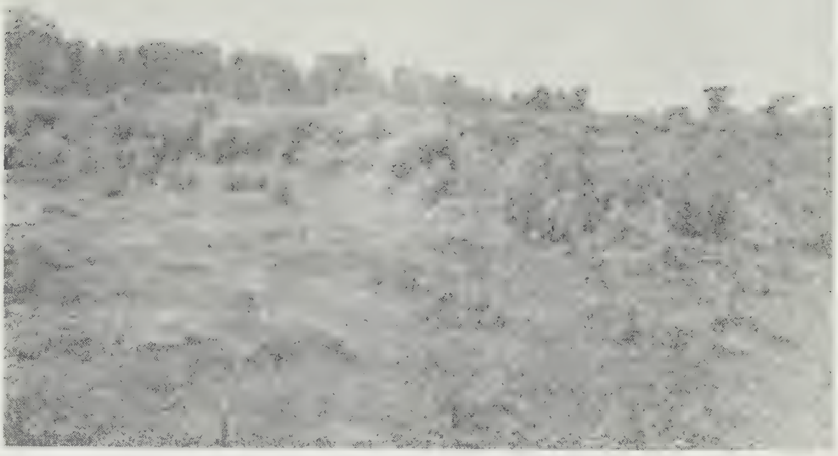
1. (1) Hay Swamp

This area comprises 10,054 acres of poorly drained sand which forms the headwaters of Black Creek in the Ausable Watershed and a stream which flows north to join the Bannockburn River, a large tributary of the Bayfield River. 2,901 acres is already wooded mostly with swamp types including silver maple, white elm and poplar. The fine stands of tamarack which originally grew here have vanished through the depredations of the larch sawfly which almost exterminated it at the beginning of the century. Six hundred acres is covered with a dense growth of scrub willow and in the southeast corner there is 148 acres of hawthorn. The open land is very low grade pasture with patches of sedges throughout.

This is one of the most important natural water storage areas in the watershed, the consensus regarding the drains which have been put through is that they have failed both to dryup the swamp sufficiently for the maintenance of good pasture and that they have not improved outlet conditions for the farms on surrounding land. Forest cover should be restored of a type which will not be affected by water standing on the land for some weeks in spring.

(2) Harpley

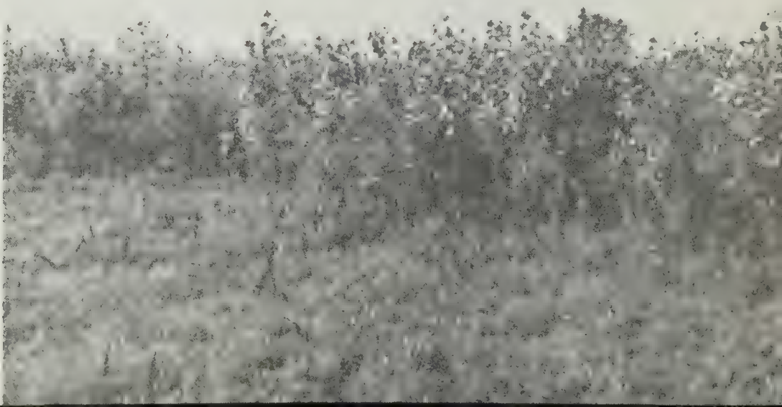
The area that is recommended for acquisition here is about 2,600 acres of poorly drained land adjacent to the auxiliary landing field southeast of Grand Bend. It furnishes water to two small streams which flow into the old channel of the Ausable River. 566 acres are already wooded mostly with swamp types but with small areas of hard maple types but with small areas of hard maple types on the better drained land. The open land consists largely of poorly drained sand and is at present used for pasture. If the landing field at the north end is to be maintained, consideration may have to be given to leaving some areas unplanted in order that the trees will not interfere with flying.



Poorly drained sand areas such as those in the Hay Swamp cannot be profitably maintained as pasture and are soon invaded by scrub willow. Cattle should be excluded and the tree cover restored.

This woodland has been ruined by cattle. All regeneration has been destroyed, sedges and low grade pasture grasses cover the area and the few remaining trees will soon die. Exclusion of cattle and discing of the soil would restore woodland in time.

Clear cutting is a vicious practice which soon makes land non productive if followed by grazing. Fortunately, it is a practice which has almost died out in the Ausable Watershed.



A potential stand of cottonwood which has seeded in a peat area south of Smith Lake.

(3) The Pinery

The Pinery has been outlined as that area of sand dunes lying between Highway 21 and Lake Huron extending from Grand Bend to Ipperwash Beach. As much as possible of this area should be acquired by the Authority immediately in order to prevent its acquisition by private owners who would spoil its natural beauty and advantages by subdivision. It is a multiple use area in which the possibilities of recreation, wildlife and forestry should be carefully apportioned and special areas set aside for each. A very small provincial park already exists at the southwest end and cottage sites are being taken up both near Port Franks and Grand Bend. The whole of the beach should be devoted to recreation as recommended in the Recreation report. Behind the first rows of dunes lie the old river channel and below Port Franks the small lakes which should be devoted to wildlife and their natural beauty maintained far nature study. The rough land of the dunes, between the river channel and the coastal recreational strip, between the river channel and the highway, and from Port Franks west to Ipperwash Beach should be maintained under proper forest management.

Of the 9,790 acres of sand dunes in this area 8,738 acres is wooded mostly with poor quality oak which has largely replaced the red pine as a result of logging and repeated fires. Under a forest management plan fire would be kept out of the region which would enable red and white pine to survive and reproduce themselves and thousands of cords of oak fuelwood would be cut every winter which would open the stand for pine and produce an immediate revenue through the sale of fuelwood. Very little actual tree planting would be required except on the open areas which constitute about 1,000 acres of dry sand land at the present time. These can very easily be reforested to pine or poplar on the areas where blow holes already exist.

(4) Smith Lake

The Smith Lake area comprising 4,461 acres lies southeast of Highway 21 and includes a strip of sand along the highway identical with that of the Pinery and for which the same treatment is advised. A very large part of this area is privately owned but it is recommended that as much as possible of it be acquired by the authority because of its wildlife and forestry potentialities. Due to inadequate knowledge of the drainage possibilities of the area and changing economic conditions the ultimate land use of part of this area has not been determined but it is felt that the Authority should have control of it and those areas which are suitable for farming should be leased as the opportunity presents itself.

Apart from the sand strip on the west there is a sandy glacial beach on the east side and a large marshy area including Smith Lake and the Goose Marsh in the centre. Of the whole area 1,829 acres is wooded, 31 acres is willow scrub and the remainder of 2,590 acres is open peat and muck of which about two-thirds is lake and marsh. The sand strip on the west is mostly covered with oak, pine and poplar types while the remainder of the woodland is swamp including silver maple - white elm and poplar types.

(5) River Bend

The area outlined here lies south and east of the muck land which is now under cultivation near the point where Parkhill Creek empties into the old channel of the Ausable River. It is felt that cultivation has been carried as far back here as is economically feasible and that the best use to which the land can be put is the growing of trees. The land itself is peat on the north and east with poorly drained clay in the western section. It embraces 2,097 acres of which 1,098 acres is wooded with swamp types including silver maple, white elm and black ash and the remainder is open land mostly covered with a dense growth of rank weeds.

(6) Arkona

The Arkona area lies mostly along the east bank of the Ausable River extending from approximately two miles north of Arkona north to the railway. It embraces 2,156 acres of rough morainic soil of which 1,105 acres is wooded and 1,051 acres is open land, most of which is pastured. There may be orchard possibilities in some parts of the region but here again it is felt that as much as possible of it should be acquired by the Authority for reforestation purposes and those sections which are suitable for pasture or other farm uses leased. The land is so rough and the slopes so steep that the growing of timber is the best use to which most of the area can be put. The present woodland consists mostly of sugar maple types with white elm types on the bottom lands.

(7) McInnis

The McInnis area is a block of about 1,000 acres of rough land on Parkhill Creek, northwest of the village of Parkhill. The present woodland of 391 acres consists almost entirely of white elm and willow types with 48 acres of hawthorn in the southeast corner. This area has considerable value from the point of view of wildlife and should be taken over by the Authority. Any reforestation scheme for the 550 acres of open land should be carefully considered in its relation to the wildlife programme.

(8) Parkhill

This is an area lying along Parkhill Creek east of the village of Parkhill. The soil is sand over till and till moraine. The total area is 1,960 acres comprising 461 acres of woodland embracing silver maple - white elm types on the bottom lands and sugar maple types on the better drained soils. 479 acres is covered with hawthorn, 17 acres with scrub willow and about one thousand acres is open land largely devoted to pasture.

(9) Bornish

Bornish is another area of about 800 acres lying along a tributary of Parkhill Creek and south of the village of Parkhill. A considerable portion of the land is poorly drained and the 326 acres of bush is composed almost entirely of white elm, ash and poplar types with 19 acres of hawthorn near the centre. The open land is largely low grade pasture and the area should be acquired with the object of rehabilitating the woodland and leasing the sections suitable for pasture.

(10) Keyser

The Keyser area lies east of Arkona near the junction of Adelaide Creek with the Ausable River. It comprises about 1,000 acres of rough topography on poorly drained clay, 326 acres of which is wooded with sugar maple and elm types, 110 acres is overgrown with hawthorn and 564 acres is open land largely devoted to pasture.

(11) Ailsa Craig

This is a small area of about 400 acres of poorly drained till soil in which springs arise which become small tributaries of the Ausable. Only 16 acres of the land is at present wooded and the remainder is used for pasture, but its acquisition by the Authority is recommended in order to protect the springs.

(12) Clandeboye

The Clandeboye area borders highway No. 4 about a mile east of Clandeboye where it crosses the Little Ausable River and would serve as an excellent demonstration reforestation area. It comprises about 600 acres of rough land of which 119 acres is overgrown with hawthorn, there is only 26 acres of woodland and the remainder is used as pasture but the slopes are steep and the area is overlooked from the highway so that it would make a perfect site for demonstrating proper planting methods and plantation management if taken over by the Authority.

(13) Staffa

This area, though small (600 acres in extent) is important from the point of view of water conservation, for within it rises the main stream of the Ausable River as a cold bubbling spring. The land is not excessively rough but at the present time it supports low grade pasture, for the most part, with only 28 acres of woodland. There are numerous wet areas covered with sedge and other wet site grasses and it should definitely be acquired by the Authority and reforested as a protection for this important stream source.

2. Haw Areas

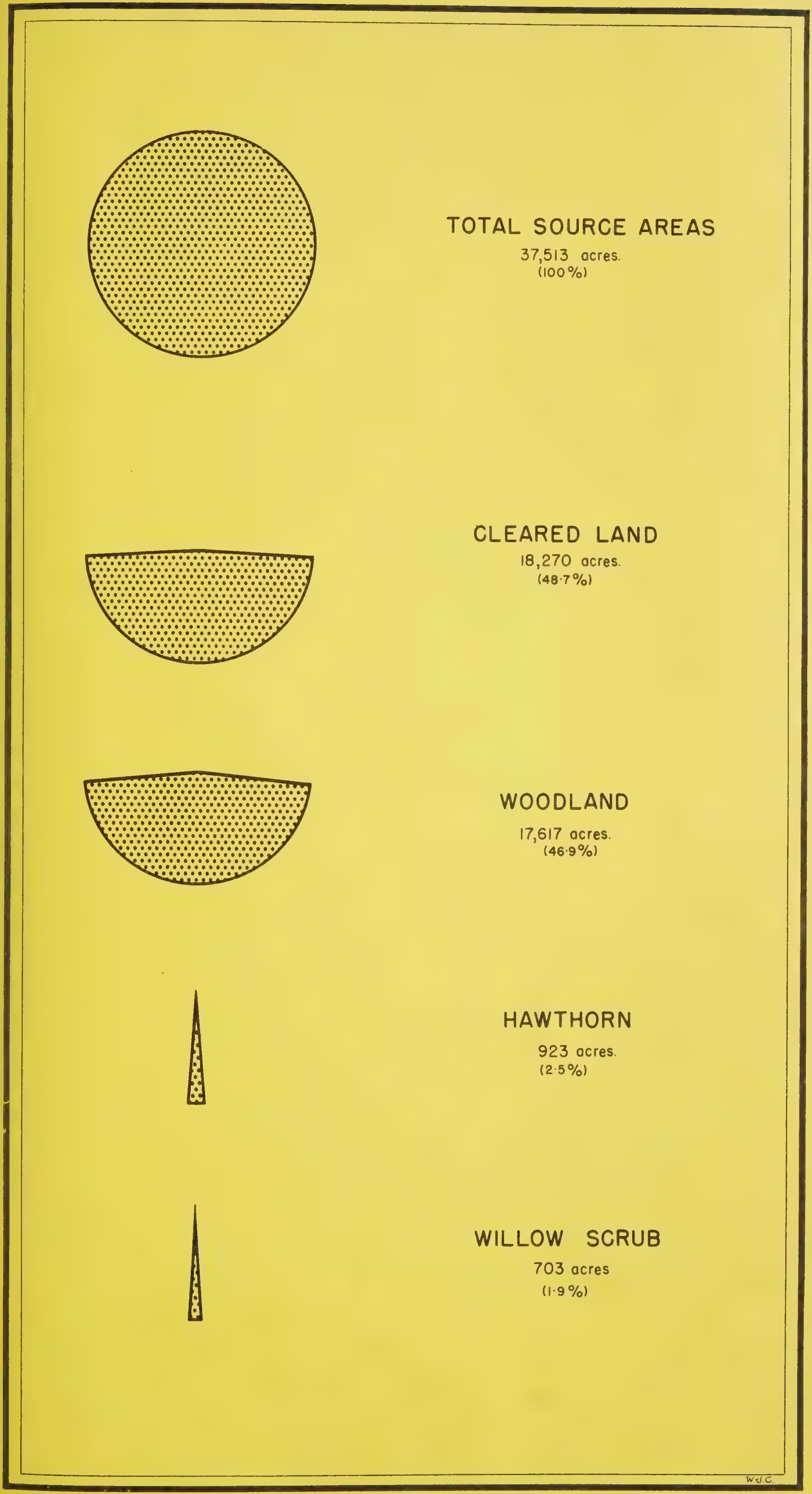
Throughout Southern Ontario, the invasion of pasture fields and agricultural land by hawthorns (Crataegus species) and wild apples (Malus, mostly escapes) is becoming a serious problem with many farmers. The Ausable Watershed is no exception. These tree weeds, like most other pests, are not limited by soil conditions to any great extent and infiltrate on a wide range of land classes.

Considerable experimental work has been done by the New York College of Agriculture[1] on methods of combatting this menace. As a result, a tool called the "Cornell Tree Killing Tool", which is like a large hypodermic needle (5' long), was developed and has proved to be very successful. When the trees have been killed they are much more easily ripped out by tractor if the roots are allowed to rot for a year or, alternatively, they may be left standing and desirable trees planted among them.

Farmers do not need to be reminded of the seriousness of this problem but they do need instruction in modern methods of attacking it and demonstrations of how to kill the trees. The value of reforestation in reclaiming certain of these areas should be emphasized and plantations established

---

[1] The Killing of Trees with Sodium Arsenite - Journal of Forestry, May, 1931.



LAND CLASSIFICATION - SOURCE AREAS

wherever feasible.

Where these areas have become fairly extensive and are adjacent to, or on, source areas they have been included in the total acreage of plantable land. In the Ausable Watershed they total 7,030 acres. Where the young bushes are still small, namely, under 4' high, or widely spaced, reforestation of the area is recommended as one of the best methods of destroying them because the trees are faster growing than the haws and soon top them, then when the tree canopy closes overhead the haws die from lack of light. When the haw bushes are older and have closed the canopy over the field so that no light reaches the soil and it becomes bare earth the problem of removal is a big one. They can be uprooted by means of tractors and hauled away to be burned in piles or they may be killed by means of the above-mentioned tool.

In many cases where the hawthorn growth is not too dense, trees could be planted under the dead hawthorns without removing them.

3. Woodlot Improvement

Improvement work in the woods in addition to planting would include the cutting of large, mature trees, the removal of dead and fallen and trees attacked by disease or infested by insects; defective and crooked trees, weed trees and those having wide, spreading crowns. Such improvement would include the cutting of this material into fuel wood as well as the scattering or burning of brush. Based on figures available for this class of work in other parts of Ontario, the time required would amount to sixty man-hours per acre.

4. Controlled Woodlot Management

Before the necessary conservation measures on that part of the watershed exclusive of the proposed watershed forest can be properly co-ordinated, some system of controlled cutting of privately owned woodlots must be established. The reason for this is that the average owner does

not take a broad view of the value of forest cover and is not interested, to any great extent, in what may happen to land or stream flow off his property. The result is that throughout the watershed there has been a systematic cutting of woodlots, both for the purposes of lumber and firewood. This type of cutting has been in progress for many years, and the portable sawmill has done a great deal of damage in removing, particularly, young thrifty trees. The system of selling acre or half-acre blocks of timber for fuelwood is also another vicious practice, for the reason that when a purchaser buys such a block, in nearly every case he clean-cuts every tree which can be used, down to an inch or two in diameter. This system has fortunately almost died out in the Ausable Watershed but some system of regulating cutting is still necessary, and certainly the areas which are connected in any way with the headwaters of streams, or the feeding of springs, should be controlled to the extent that they cannot be clean-cut.

Where conditions warrant, a certain amount of cutting would be continued, but such trees should be marked by a competent person and provision made for restocking, where necessary. The intention would be to interfere as little as possible with the economy of farm property, where the supply of wood is concerned, but in some cases it would be necessary to subsidize the owner in the form of supplying him with fuelwood, or lumber. A large quantity of such material would be available, however, from thinnings and improvements from the Ausable Forest, and could be used in this way.

The question of clean-cutting of woodlots on this area, and for that matter throughout all of Southern Ontario, is of serious import, and is one of the chief reasons why some system of control should be instituted. For many years now conservationists have advocated controlled cutting of woodlots. In some sections, particularly in tobacco growing

counties such as Norfolk County, the destruction of woodlots for the curing of tobacco has become alarming. It is admitted that the question requires delicate handling, but where the good of the whole community is envisaged, some middle road of agreement could be arrived at. Furthermore, the distribution of free trees by the government for conservation purposes is sometimes criticized, and rightly so, where on one farm the owner plants an area with seedlings and in the same year his neighbour clean-cuts a woodlot which perhaps protects the head-waters of a stream. In fact, so distorted is the relative value of tree planting versus established woodlots in the minds of some people that there are examples on record where municipalities have purchased land for reforestation and have allowed the owner to cut the timber before giving title.

It is admitted, of course, that there are extenuating circumstances when a farmer may consider it necessary to raise money by selling timber. This in itself is not so serious if the cutting is done in such a way that the benefits of the forest are retained. Young forests, as well as old, protect the soil and have water regulating value, and the clean-cutting of such areas is a destructive and vicious practice which should be stopped.

The basis on which a regulation of this kind should be carried out is a consideration of the woodlot concerned. To make a blanket ruling that all woodlots on the Ausable should not be cut, or should come under one type of control measure, would not work to the best advantage of the community, and certainly would not be in the interests of good forestry.

Some woodlots have reached the stage in which they are worn out and if the land is good should be cleared off and cropped. Others may be composed of a high percentage of worthless species and have no relation to water regulation in the countryside, and likewise could be disposed of to

advantage. But, where the woodland has a direct bearing on water regulation, erosion, retarding of the wind, and similar benefits, the desire of the individual should be sacrificed for the good of the community. The whole question, therefore, resolves itself into an examination of each woodlot by a competent person, and the prescribing of a programme of management to suit each case.

The basic method of control usually advocated is cutting to a diameter limit, that is, that all trees below a certain diameter - for example, ten inches - should not be cut. Such a regulation may or may not be good forestry. In most cases it would not be because there would be much worthless material below this diameter limit, such as poplar, thorn, willow and other species, which should be taken out. At the same time there would be certain large trees above the diameter limit which should be left for the benefit of the forest, as well as trees suitable for re-seeding the area. The diameter limit should not be a fixed rule, but simply a guiding principle; a sort of yardstick on which the land owner can base his calculations. In an area the size of the Ausable a programme of individual woodlot examination should not be too heavy a burden on the Conservation Authority.

The counties of Huron, Middlesex, Perth and Lambton all passed by-laws under the Ontario Trees Conservation Act defining the minimum diameters of trees which may be cut as follows:

	White and Red Cedar	All other Species	
Huron	5 inches	12 inches	- To be measured 4'6" above ground
Middlesex	6 "	14 "	- To be measured 1'6" above ground
Perth	5 "	16 "	- To be measured 4'6" above ground
Lambton	7 "	12 "	- To be measured 1'6" above ground

When the forest survey was made in 1947, each woodlot on the Ausable was examined, so that there is already on file a report showing the condition of each of these and from the reports the necessary data have been deduced, which indicates the types of work which are most urgent. These consist of improvement thinnings and plantings. Such a service could be counted by the land owner as a form of subsidy, in return for relinquishing absolute cutting rights in the woodlot. It should be clearly stated, however, that all land on which regulated forest is found would remain in the possession of the present owner, and the woodlot would still be his to possess and enjoy as before, but intrinsic forestry value of the area would be controlled to the extent that its benefits in this regard would remain permanent for the community.

The most progressive forestry step taken in Ontario in many years was taken by Halton County in 1948 when the County Council passed a by-law to aid farmers in fencing their woodlots from cattle.

The by-law states that the County of Halton will grant a sum equal to the prevailing cost price of 8-strand fence wire with a single barb (not the cost of posts or labour) to a woodlot owner who will erect such a fence on one or more sides of his woodlot in order to completely enclose the woodlot thus fostering forest growth by keeping livestock out. The woodlot must be of a size not less than two acres and livestock must be excluded for a minimum period of ten years.

Such action is of infinitely more value than the planting of many millions of trees artificially and the Ausable Authority is urged to inaugurate a similar scheme in the lands under its jurisdiction.

CHAPTER 6

FOREST INSECTS AND DISEASES

Forest Insects

In any project, such as proposed for the Ausable Watershed, careful consideration should be given to the prevention of insect outbreaks and adequate arrangements made for the immediate application of control measures when these become necessary. While it is not possible to predict accurately the course insects may take under the ever-changing conditions of a newly forested area, there are a number of fundamental principles which, if applied, will greatly lessen their destructiveness.

It is important to avoid the planting of large areas to one kind of tree, otherwise conditions will be ideal for an out-break of abnormal numbers of some insects which prefer the food afforded by that particular host. It is preferable to plant in blocks, the blocks distributed so that trees of one species are separated by blocks of different tree species. This tends to keep outbreaks localized until natural agencies bring them under control and facilitates direct control measures if such become necessary.

It is important to plant only the species of trees suitable to the site and existing growing conditions. Healthy, vigorous trees are certainly more resistant to insect attack than weak, struggling ones.

Over-mature and dead trees should be removed from the existing stands as these harbour bark-beetles and wood-boring insects, which may become excessively abundant and attack healthy adjacent trees.

Care should be exercised to prevent ground fires. Even light ground fires are frequently followed by severe outbreaks of bark beetles and wood-boring insects.

Woodcutting operations, sawmill sites and wood storage yards should be carefully supervised or they may

become reservoirs of infestations.

It is essential that surveys for insect conditions be made each year so that any abnormal increase in insect populations may be noted and control operations initiated before they develop to outbreak proportions. Serious and widespread outbreaks are frequently prevented by prompt and well-timed spraying operations over a comparatively small area. It is therefore necessary that spraying equipment be available and that laneways be maintained within the plantations for spraying purposes. Outbreaks of an extensive nature can generally be brought under effective control by strip spraying. In this method, alternate strips of trees in large plantations are sprayed, thus reducing the initial infestation and at the same time causing the native parasites to concentrate and build up in the unsprayed portions. This reduces spraying operations and the number of lanes for the passage of spraying equipment.

Owing to the danger of injury by the white pine weevil, white pine should not be planted in pure stands unless the stands are very densely stocked in a good site. It is better to grow white pine in mixture with some immune species, such as the better hardwoods. The protecting species should be taller than the white pine, at least in the early years.

In conclusion, it should be recognized that protection against leaf-feeding insects is very desirable since defoliation of a tree weakens it and thus makes it more susceptible to attack by bark-beetles and wood-boring insects as well as by organisms which do not usually attack healthy trees but which will hasten the death of weakened trees. Leaf-feeding insects alone may kill a thrifty, broad-leaved deciduous tree by completely defoliating it for three years in succession. Conifers, however, are usually killed as a result of one complete defoliation.

Tree Diseases

(a) Introduction:

Productive woodlands require protection against fire, trespass, grazing animals and rodents, insects and disease. Protection is a part of forest management, and under a policy of sustained yield will be maintained in continuity. Good forest management is reflected in the health of the woods and, conversely, damage on account of disease is often a sign of mismanagement or neglect. In general, an objective of maximum yield, with attendant intensive silviculture, is compatible with, and often facilitates protection and disease control.

For the purpose of discussing their pathology and protection, the hardwoods may be considered separately from pine in natural stands or plantations. The chief diseases of the hardwoods are the various trunk, butt and root rots, and chronic stem cankers, which are all endemic, and may cause serious damage under aggravating conditions. Woodlots on the Ausable Watershed present very diverse conditions with respect to the incidence of these diseases, a circumstance which is usually related to their past history. Thus many containing old timber are in need of heavy preliminary salvage and sanitation cuttings, as a result of mismanagement or neglect. Such cuttings should precede or be combined with cleanings and improvement cuttings, designed to improve the composition and structure of the stands. Having established a sanitary condition, normal care should maintain it, and obviate loss on account of decay.

The wood rots are commonly thought of as diseases of mature and over-mature timber, but experience has shown that infection may occur at a very early age. Thus in hardwood sprouts, the stem may be infected from the parent stump. In older trees, infection is chiefly through wounds, either of the root or trunk, which may be caused by fire,

trampling by animals, insects, meteorological agencies, or by carelessness or accident in felling and other woods operations.

Hardwoods are commonly cut selectively and not infrequently in clear fellings. Few foresters will approve the latter system, which is in fact often intended as a liquidation of the property. A system based on yearly selection, or frequent periodic return to conveniently planned subdivisions, has obvious advantages for small woods, and is well adapted to the control of decay.

For many reasons "cleanings" in the reproduction are desirable, especially where the woods have been heavily cut. While favouring the valuable species, those sprouts which, on account of decay hazard are of undesirable origin, should be eliminated. Such will comprise sprouts from the larger stumps, and those from above-ground position.

In harvest cuttings, which should recur at frequent intervals, the permissible volume allotted should include trees in which incipient decay is discovered, and so far as possible those which have become a poor risk through injury or other circumstance.

White pine is found in young plantations, and in natural stands, almost pure, or mixed with hardwoods. From the latter stands it tends to disappear, on account of hardwood competition, except on sites which are particularly favourable for its reproduction. The white pine blister rust, which, with the well known shoot weevil, is a principal enemy of the species, is a factor contributing towards the elimination of seedlings and young trees.

White pine should be encouraged on those sites which are naturally suited to its reproduction, so that fairly compact growth may be secured, thereby facilitating the protection problem. It is an important and valuable species in southern Ontario, and its cultivation should be promoted by the institution of effective blister rust control facilities.

CHAPTER 7

LAND ACQUISITION

The problem of land acquisition in any part of agricultural Ontario, where practically all the land is privately owned, is one which requires careful approach. The ownership and use of land, especially for agricultural purposes, is considered by most citizens as one of their few remaining inalienable rights. However, where the good of the whole community is under consideration, such personal rights should be, and have been, overruled under the principle of eminent domain. Examples of such cases are the building of highways, the construction of power lines, and the acquiring of land for military purposes in the event of a national emergency.

In southern Ontario, compulsion has not been exercised to any great extent by the Government in planning proper land use schemes. But who would gainsay the fact that the acquiring of poor land on the Ausable Watershed for conservation purposes does not constitute a national emergency, and therefore requires a more permanent authority than the individual to bring it back to its proper use?

However, in dealing with land acquisition, it should not be the desire of any authority to approach the problem in a dictatorial manner. It will require careful handling, and as a preliminary step in such work the people of the area should be acquainted with the purpose of the scheme, its ultimate benefits to the community, and by explanation and demonstration be gradually brought to the point where they will be glad to co-operate.

The only part of the Ausable where large scale transfers of property from private ownership to a forest authority would have to be made is those areas which are recommended as source areas and reforestation land.

It is true, of course, that there are fewer farms in the area which are as good as many in other parts of the watershed, but in any large area of poor land on which some agriculture is being practised, this might be the case. However, it is not essential that the best farms be withdrawn entirely from agriculture, but an arrangement could be arrived at so that such farms, where the upkeep of public utilities is not too heavy, could be retained as agricultural land. Such areas could be incorporated into the forest as farm land, and be used by forest workers for this purpose; one supplementing the other at different seasons of the year.

1. Methods of Acquiring Land

There are several ways in which land can be acquired and controlled for conservation purposes, and it is proposed to enumerate and discuss these briefly in this section.

(a) Transfer by Private Sale:

The most satisfactory method of acquiring land is by private sale between the Conservation Authority concerned, and the land owner. This method has been followed by the counties of Ontario in purchasing land for reforestation work in building up the system of county forests, which totals, in round figures, 45,000 acres. This method has its drawbacks, however, as individuals who have not the community's welfare at heart, or for one reason or another have an exaggerated idea of the value of their property, may block the completion of a unified area by refusing to sell. This was overcome in the State of New York, where over 450,000 acres of land have been purchased for reforestation, by refusing to buy individual parcels of land unless there was a sufficient number in a group to make a contiguous block of 500 acres.

(b) Maximum Price per Acre:

Another method which has been used has been to fix a maximum price per acre for this class of land, beyond which the forest authority is prohibited to go; allowance

being made for the presence of good fencing and buildings on the properties, which in some cases have been removed by the vendors and allowed as part payment for the land.

(c) Agreements:

Where owners of property prefer to retain their woodlots, or where part of farms fall within the forest area prescribed, and providing the retaining of ownership does not jeopardize the complete conservation scheme, agreements could be made for the control and management of such areas.

This method has been adopted by the Dominion Forest Service in Nova Scotia, where it has been desirable to control wooded areas for experimental and conservation schemes, and in this particular case the agreements cover a period of twenty years.

In Ontario there is one example, at least, where a municipality leased a part of a farm for reforestation work for fifty years, and one United Counties' council has adopted the plan of taking easements on land for the same purpose.

(d) Control by Existing Legislation:

Under the authority of the Private Forest Reserves Act (R.S.O. 1937, Chapter 324), the Minister of Lands and Forests, on recommendation to the Lieutenant-Governor in Council, may, with the consent of the owner of any land covered with forest or suitable for reforestation, declare such an area to be a private forest reserve. When such an arrangement is made, the Minister, or his representatives, may reforest such areas, supervise the improving and cutting, and prohibit the removal of trees by the owner without his consent, and also prohibit the grazing of the area by cattle.

(e) Life Lease:

Many of the farms on the proposed forest, as already mentioned, are of low agricultural worth and are supporting families at the present time. The problem in such

cases is not so much the purchase of the property, as what will become of the family after the farm is acquired. In almost every case it would be impossible for the vendor to purchase another farm with the money he receives, except one which is of approximately the same value, outside the forest. In some cases such farms are occupied by older people, whose families have grown up and left the community. The removal of these from their properties might work undue hardship on them, and in fact in some cases they might become a burden on the municipality. With some of these, the plan of giving the vendor a life lease would be sufficient. In most cases such old people make little attempt at farming the whole property, but require only sufficient pasture for a cow or two, enough land for a garden, the house and buildings; and a supply of fuelwood. The plan of giving a life lease has been adopted in the case of two properties[1], at least, on the county forests in Ontario, and has proved satisfactory to both contracting parties.

(f) Tax Delinquent Land:

Under the Statues of the Province of Ontario[2], land which becomes tax delinquent is sold by the County Treasurer. In the case of farms this is not done in practice until the land has been in default for three, or in some cases, four years. Even then the owner has the privilege of redeeming his property within a year. Where such lands are marginal or submarginal, they are sometimes bought for only a part of the area which is of special value, such as woodland, old buildings, or a good field or two. In some instances the poor land remains idle and frequently appears again at the tax sale. The fact that such land becomes tax delinquent is an indication in many cases that its ultimate use is forestry. Under the present Statutes the municipalities are not permitted, at the first sale at least, to acquire or reserve

---

[1]Northumberland Forest and Angus Forest

[2]R.S.O. c. 262. Sec. 148

such land for conservation purposes. Consequently this report recommends that the Authority expropriate all tax delinquent land subject to the regulations of the Municipal Act.

(g) Expropriation:

As a last resort in land purchases, or where the owners of abandoned land cannot be located, such areas can be acquired by expropriation. The Conservation Authorities Act, 1946, Chapter 11, Par. 13 states:

"For the purpose of carrying out a scheme an Authority shall have the power to purchase or acquire and without the consent of the owner, enter upon, take and expropriate any land which it may require and sell or otherwise deal with such land or other property."

Also under the Forestry Act, (R.S.O. 1937, Chapter 39, Par. 13) provision is made for the removal of settlers from lands unsuitable for farming. To quote:

"Whenever in the opinion of the Minister, it is found that settlement has taken place on lands not suitable for agricultural purposes, and which said lands are required for forestry purposes, the Minister shall have power to make arrangements for the removal of such settlers upon such terms as may be agreed upon."

As a matter of general interest, it should be stated that this Act also provides for the power to close the roads on lands taken over for forestry purposes, the setting apart of lands for settlement, and the removing of settlers from lands unsuitable for farming. It should also include, however, provision for acquiring permanent or community pastures, and pondage areas where these are required, as an integral part of a large conservation project.

2. <u>Cost of Land in the Proposed Ausable Forest</u>

It would be impossible to give an accurate figure for the total purchase price of all land in the proposed forest without consulting the owners of the individual parcels. However, as an indication for arriving at the

approximate cost, the amounts paid by the several counties of the Province in purchasing land for their forests will serve as a guide.

TABLE SHOWING COST OF LAND PURCHASED FOR FORESTS

Name of Forest	Owned By	Acres	Cost	Cost Per Acre
Ganaraska	Ganaraska Authority	3,253	$ 22,078.00	$ 6.78
Thames	Thames Authority	1,705	7,546.00	4.42
Angus	Simcoe	991	5,639.75	5.69
Dufferin	Dufferin	1,077	7,945.32	7.37
Durham	Northumberland and Durham	1,074	9,561.00	8.90
Grey	Grey	463	2,896.00	6.25
Hendrie	Simcoe	2,250	13,921.00	6.18
Larose	Prescott and Russell	14,416	33,188.00	2.30
Limerick	Leeds and Grenville	1,789	5,367.00	3.00
Miller Lake	Bruce	3,553	8,234.25	2.32
Northumberland	Northumberland and Durham	960	5,920.00	6.16
Orr Lake	Simcoe	2,319	14,589.25	6.29
Sauble	Bruce	1,484	4,177.94	2.81
Tosorontio	Simcoe	600	3,300.00	5.50
Uxbridge	Ontario	975	9,050.00	9.28
Victoria	Victoria	1,715	5,061.00	2.95
Vivian	York	1,174	19,516.00	16.62
Totals		39,798	$177,990.51	$ 4.47

In the above table a cross-section of land costs for some of the county forests will be found. Lanark County is not listed as the land for this was not purchased by private sale. Norfolk and Peterborough Counties, which have large acreages in their forests, do not come under the county forest agreement. It should be pointed out, that the acreage listed under each forest does not, in all cases, represent the total acreage of that forest to date, but only a part of it which was purchased by private sale. Of the remaining land making up the total acreage on some of the forests, some was tax delinquent and was therefore purchased at a low figure, some was purchased from the Crown at a nominal sum, while of the remainder the particulars regarding area, cost and nature of purchase, have not yet been listed with the Department.

It should be pointed out too that land acquired in the future by the Ganaraska Authority is likely to cost more than the average price per acre of $6.78 because most of the poorest denuded land has now been taken up and the remainder has more woodland and potential woodland which will naturally raise the purchase price. The very low cost of land in the Thames Watershed is explained by the fact that it is nearly all burned over swamp land with a peat soil which is of no economic value at the present time. Actually the average price of $4.42 per acre includes a ditch tax which existed as a lien against the property so that the price of the land itself was closer to $1.00 per acre. However, it is potential forest land having produced black spruce, tamarack and white pine in its original state and is also essential to the water conservation programme.

WATER

CHAPTER 1

THE RIVER

1. General:-

The names used by the original Indian inhabitants - Hurons, Neutrals and Fire Indians - to designate the Ausable River appear to be unknown. In 1819, the Chippewas of the neighbourhood, according to Lieutenant Willson, called it "Nagan-Sippe" (Nagansippi), which Willson translates as "Sandy River". The French explorers named it "La Rivière aux Sables", which might possibly mean the sandy river, but more probably "The River with the Sands" or "at the Sands"[1] (i.e. the sand hills near the mouth). The English surveyors at first used the French name in its correct spelling, but it was soon corrupted in a number of different ways, of which "Sable" or "Sauble" were preferred by the settlers for many years. The present official name "Ausable" appears to have been selected from these corruptions as a convenient compromise, which would distinguish the river from other "Sable" and "Sauble" Rivers and suggest the original French name in a simplified spelling. Some of the variant spellings are still used locally, however.

The River Ausable drains 665 square miles of land, east of Lake Huron and near the southern extremity of the lake. The mouth of the river is about thirty-six miles south of Goderich. The sources of the main river are in Perth County, near the village of Staffa, at an elevation of about 1,075 feet above sea level. The direct distance from this source area to the lake is only about twenty miles and Black Creek, a tributary which joins the river west of Exeter, has one of its sources near Zurich and only five and a half

---

1. Compare such names as Ile aux Coudres, Pointe-aux-Trembles, and Pointe-au-Pic.

[illegible]

AUSABLE RIVER AND MAIN TRIBUTARIES

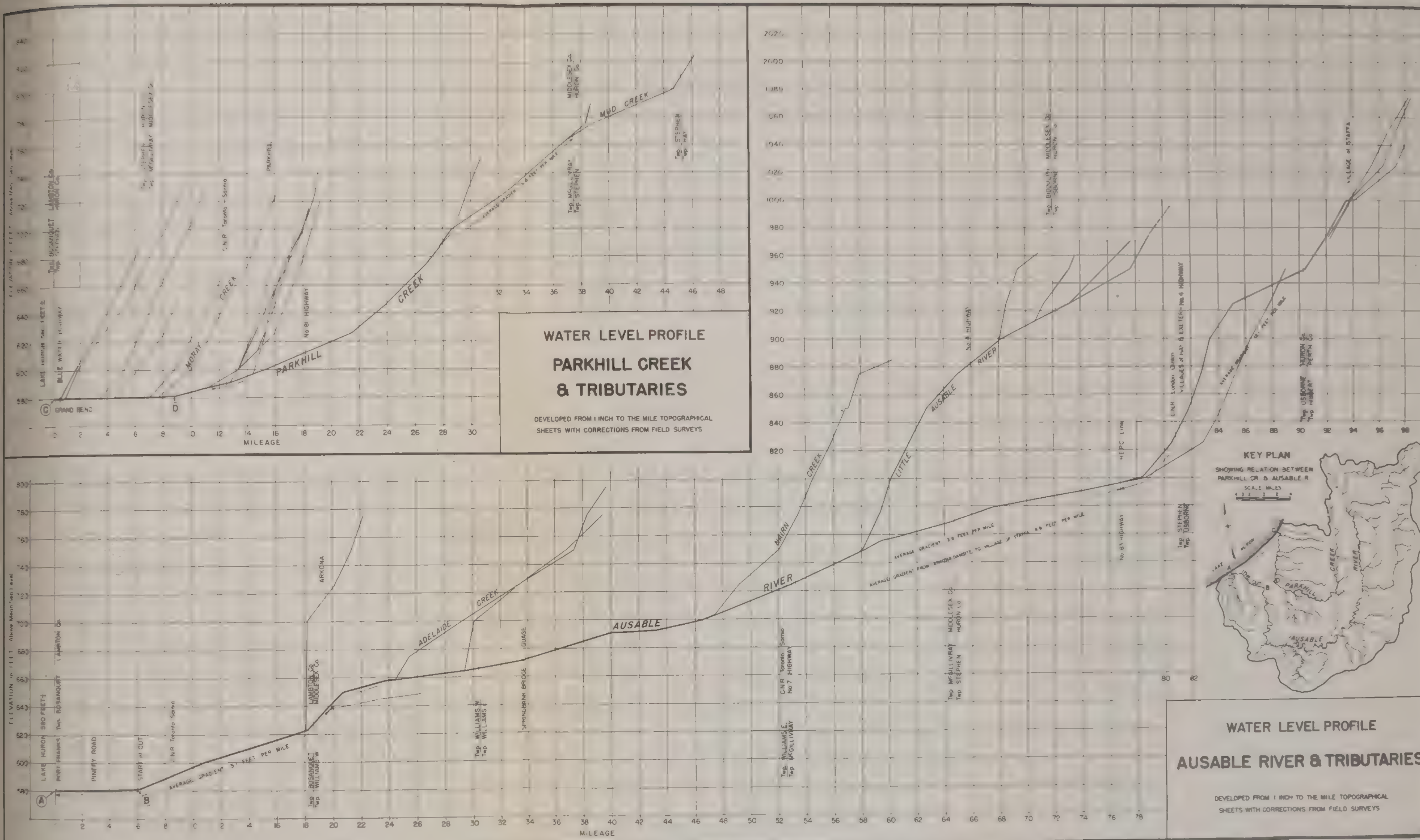
SCALE: MILES

1 0 1 2 3 4 5

miles from the lakeshore. Nevertheless, the Ausable originally flowed about 110 miles before reaching Lake Huron, following a course of which the outline has aptly been likened to that of a barbed fishhook. After flowing south from a little west of Exeter to beyond Clandeboye near Lucan, the river swept westwards in a wide half-circle and then flowed northward from near Arkona till it was about a quarter of a mile from the lake at Grand Bend. Here the river made another sharp turn through about 180° and flowed southwest behind the sand hills for about twelve miles until it was able to make its way through them to the lake. In 1873-5 the course of the river was altered by cutting a channel from a little below the boundary between McGillivray and Williams West Townships to Port Franks, cutting off "the Bend", most of which, however, still served as the channel of Parkhill Creek, the chief western tributary of the Ausable. In 1892, a "Cut" was made at Grand Bend through the old portage, so that this creek now drains into Lake Huron, independently of the main river.

Parkhill Creek, called Mud Creek in its northern part and Ptsebe in its lower reaches, has its source on the eastern slope of the divide, two miles northeast of Dashwood, and flows roughly parallel to the main river for about thirty-eight miles, joining the old Ausable seven miles above Grand Bend. From the headwaters to this point, the average gradient is 6.8 feet per mile.

The tributaries to the old Ausable, between its confluence with Parkhill Creek and Grand Bend, have an important influence on the flood problem in the flats below. There are six creeks emptying into this part of the river having an average gradient of 17.5 feet per mile and which drain an area of about 90 square miles. This comparatively large area has a rapid run-off and is a factor contributing to the flood problem in the flats below. Owing to the lack of adequate sites for storage reservoirs the run-off of this particular area cannot



WATER LEVEL PROFILE
PARKHILL CREEK & TRIBUTARIES
DEVELOPED FROM 1 INCH TO THE MILE TOPOGRAPHICAL SHEETS WITH CORRECTIONS FROM FIELD SURVEYS
PARKHILL
CREEK
MUD CREEK
MORAY
CREEK
GRAND BEND
No 81 HIGHWAY
MILEAGE
WATER LEVEL PROFILE
AUSABLE RIVER & TRIBUTARIES
DEVELOPED FROM 1 INCH TO THE MILE TOPOGRAPHICAL SHEETS WITH CORRECTIONS FROM FIELD SURVEYS
KEY PLAN
SHOWING RELATION BETWEEN PARKHILL CR & AUSABLE R
AUSABLE
RIVER
LITTLE
AUSABLE
RIVER
NAIRN
CREEK
ADELAIDE
CREEK
ARKONA
PINERY ROAD
PORT FRANKS
LAKE HURON
SPRINGBANK BRIDGE
GUAGE
No 7 HIGHWAY
No 81 HIGHWAY
VILLAGE of STAFFA
AVERAGE GRADIENT 3.7 FEET PER MILE
MILEAGE

be effectively controlled and constitutes a major part of the "Uncontrolled Area" in Figure H-1 of the chapter on Hydraulics.

The Little Ausable, the chief eastern tributary, rises some six miles east of Exeter and flows south from near Elimville, parallel to the main stream. About a mile west of Lucan, it turns to the west and joins the Ausable nearly four miles west of Clandeboye, about twenty-three miles from its source. In that distance, it falls about 155 feet or nearly 6.7 feet per mile.

One branch of Black Creek[1], the tributary which drains the northwestern part of the watershed, has its sources east of Hensall, while another rises northwest of Zurich. Black Creek joins the main river about three miles west of Exeter.

Nairn Creek, in the southeastern part of the area joins the Ausable near Nairn, after flowing a little more than thirteen miles from its sources near Denfield, in Lobo Township. However, its average gradient is about fourteen feet per mile and for six miles of its course is about nineteen feet per mile. This combined with a reliable flow of water made Nairn Creek, and particularly the branch once called the "River Lyon"[2], the best source of water power in the watershed.

The Ausable River falls nearly five hundred feet between its source near Staffa and Lake Huron. From the village of Staffa to below Exeter, the gradient is 12.1 feet per mile, but from about four miles below Exeter to the "Gorge"

---

1. Originally called Warren's Creek (1856). There was "a small sawmill" on this creek from before 1846 till after 1858. (Bell's Mills, Lot 20, Con. III, Hay Township). Later a carding mill was built there, and before 1870 another sawmill was built on Lot 20, Con. IV. The existing sawmill is on Lot 20, Con. III.

2. Called "Siddall's Creek" in 1857 and the "River Lyon" in 1870.

near the Williams West - Bosanquet boundary the fall is less than three feet per mile on the average. At this point the river runs through a deep rocky ravine and falls about thirty feet in three miles, in a series of rapids. From the "Gorge" to the beginning of the "Cut" the average gradient is a little over three feet per mile. From the mouth of the "Cut" at Port Franks to the source near Staffa, the length of the river is now about ninety-eight miles.

2. Floods in the Past:-

Although the Ausable was one of the larger rivers flowing into that part of Lake Huron, and though its valley extended so far inland, it was never of much importance as a waterway even to the Indians. This was due only in part to its tortuous course, to rapids or to lack of water. Lack of water, no doubt made some upper reaches useless in summer, but there seems to have been plenty of water between Grand Bend and Rock Glen, and doubtless also in parts of the river above these rapids. It should have been possible, with some portaging, to have used the river to a point within about sixteen miles of the Thames, but this was rarely done even at high water[1]. The chief obstacles to the use of this lower part of the river resulted from the heavy and regular flooding, just as the low summer flow limited the usefulness of the upper river and some of its tributaries for the purposes of water supply or of water power.

That these floods have always been a characteristic of the Ausable system, can hardly be doubted. It is obvious that the lowlands in McGillivray, Stephen and Bosanquet Townships have been regularly inundated for many centuries, while most of the rest of the river shows the "flats" or flood meadows, and old flood channels which are

---

1. A portage from near Nairn to above Delaware is marked on the Canada Company Map based on the surveys of 1826 but Willson's account indicates that a longer route was preferred.

characteristic signs of flooding to be found on most Ontario rivers. Besides, it is evident that a great deal of soil and forest debris was brought down in the remote past by the floods and deposited in the low area along the lower course of the river, blocking long stretches below the "Gorge" with logs and silting up the channel between Grand Bend and Port Franks. The earliest extant description of the river for about eighteen miles above Grand Bend reads like that of a river above a log jam during the "run".

This description is contained in the letter and report sent in September 1819 to the Royal Engineers Headquarters at Quebec by Lieutenant Willson, and already referred to in the chapter on Land Settlement. A facsimile of a part of these documents is reproduced in this report. In the letter, Willson writes to explain why his survey was incomplete:

"I was not able to extend my survey further from the obstacles on the river. The number of fallen trees, and the quantity of drift timber being such as to prevent the passage of any canoe. Previously finding it impossible to proceed in a birch one from breaking it continually upon sunken trees in the river - I had purchased a wooden one from an Indian, but even with this though very small, I was not able to advance further in my survey. I followed the course of the river on foot, for about ten miles to see if the impediment diminished, but the whole of the distance except here and there for 100 yards, was choaked up in the same manner. - Sometimes the accumulation would be such as to form almost a complete Causeway for above a quarter of a mile along the river and elevated three or four feet above the surface of the water. - Where I stopped it had every appearance of being navigable for Bateaux a considerable distance further as the water was Six and Eight feet deep, with but the least current. The Indian I had with me, stated that in the beginning of the Summer before the water has much fallen, he is in the custom of ascending the river from whence to the Houses on the Thames in Delaware it was between twenty and thirty miles. - The only time to survey this river is in the Spring, the end of April or beginning of May, when a Canoe or light Skiff can pass over all obstacles, or at least most of them."

It was these obstacles which closed the river to canoes and that they were due chiefly to floods is clear from portions of Willson's report. He says that as you ascend the river about six miles from the mouth the ground on the right

"begins to lower ----- the soil to become clayey and loamy and a little further to show marks of being inundated every spring -----" (between Port Franks and Grand Bend). After passing Grand Bend, "in about a mile the land on each side

Extract of a letter from Lieutenant Wilson Royal Engineers Amherstburgh; to Lieutenant Colonel Durnford Commanding Royal Engineers dated Amherstburg 27th September 1819.

"I have the honor to enclose a plan of part of the river aux Sables — I was not able to extend my survey further from the obstacles in the river. The number of fallen trees and the quantity of drift timber being such as to prevent the passage of any Canoe; previously finding it impossible to proceed in a birch one from breaking it continually upon sunken trees in the river — I had purchased a wooden one from an Indian, but even with this though very small, I was not able to advance further in my survey. I followed the course of the river on foot, for about ten miles to see if the impediment diminished, but the whole of the distance except here and there for 100 yards, was choaked up in the same manner. — sometimes the accumulation would be such as to form almost a complete Causeway for above a quarter of a mile along the river and elevated three or four feet above the surface of the water. — Where I stopped it had every appearance of being navigable for Batteaux a considerable distance further, as the water was six and eight feet deep with but the least current. The Indian I had with me, stated that in the beginning of the Summer before the water has much fallen, he is in the custom of ascending the river from whence to the Houses on the Thames in Delaware it was between twenty and thirty miles. — the only time to survey this river is in the Spring, the end of April or beginning of May, when a Canoe or light skiff can pass over all obstacles, or at least most of them."

of the river begins to shew marks of being inundated every spring, it is here about four feet above the level of the water in summer and shews evident signs of being overflowed to the depth of between 2 and 3 feet in the woods, which are here full of heavy timber. - The Indians state it also to be the case. - As you advance the land lowers, and continues to do so, until it is not more than a foot above the water. - About a mile before my survey finished this takes place, and continues at that level for near three miles, when the ground begins to rise, and in four miles further up the river attains that height as puts it above the rise of the water in the Spring. The body of water that then comes down must be very great, where it is confined to the banks, the river rises nine feet, and is between 60 and 70 yards wide, where it overflows them, the rise is less than six feet, and the width not more than thirty feet though with a depth of 12 feet close to the sides[1]. The extent of Country subject to inundation I could not ascertain very exactly, but can give a pretty correct general outline of it. -"

He proceeds to do so very accurately on the whole, though he slightly over-estimates the dimensions of the low ground. He then describes Lake "Burwell" and says that "from where the land is inundated in the Spring you may cross through the woods in a Canoe to this Lake -". Willson's estimate of the size of this lake is much greater than that made by Mahlon Burwell in 1826. Willson says the lake was about six or seven miles long by three or four miles wide. He probably regarded all three small lakes or ponds, with the marshes between them, as one body of water. Burwell seems only to have seen the southernmost of the three (Lake Burwell, now drained). It is possible that Burwell's visit was later in the season than Willson's and that the wild rice in the marsh was taller and made the area of water appear much smaller[2].

The references to the flooding of these lowlands continued through the early period. The permanent wetness of these lands and the regular flooding limited their

---

1. The widths given appear to be those of the river at times of normal flow.

2. Willson's letter is dated September 27, 1819, but it may have been written some weeks after his visit to the Ausable. Later descriptions of "Lake Burwell" (1846) mention two lakes joined by "a narrow gut". There appears sometimes to have been a third and much smaller stretch of open water beyond Smith Lake.

The Old Ausable at the site of Brewster's Mill.

Logs in the bank of the Ausable near Thedford. The figure gives the size. These may be part of the logs which covered the river "like a causeway" in 1819.

Spring east of Staffa, Hibbert Township. One of the higher sources of the Ausable River.

settlement until after 1875. The situation had not been improved by the building of the Brewster milldam in 1832, which permanently flooded a large area and obstructed the run-off of the freshets. By the fifties settlers were taking up farms around the edge of the drowned lands. They found that the floods made much of their level land useless except for pasture and were often forced to drive their stock into the sand hills to escape the freshets. They were inclined to blame Brewster's dam for most of their troubles, probably more than the facts warranted.

When the Canada Company's attempt to get rid of the dam failed in the courts, these farmers burned the mill and destroyed the dam in the early sixties. The floods went on, however, and the dam was rebuilt about 1868. However, since the new grist mill had auxiliary steam power from the first, the dam may have been smaller, and in any case the mill was converted completely to steam within ten years and the dam abandoned.

In the meantime, the "Cut" to Port Franks had been built (1872-75). This greatly improved conditions south of the "Cut", but the run-off from Parkhill Creek and other streams still had to make its way to the Lake by the old channel. From Grand Bend to Port Franks most of this channel was never more than a few feet deep[1], and ice and logs naturally jammed here in the freshets as well as at "the Bend" and above it. The area around Lake Smith was still flooded for many miles every spring and often at other times of the year.

The cutting of another channel through the portage from "the Bend" in 1893 was largely a measure of flood control, but it was not completely successful. The ice often

---

1. Willson's soundings of 1819 give from 1¾ to 3 feet for this part of the river. It was always impassable for boats.

jammed in the "Cut" and backed up the water, and the risk of this happening was increased by the formation of sand bars at the mouth of the "Cut", as was the case after the freshet of 1894. The building of "a pier and water break" some ten years later probably helped to some extent, but the trouble continued. In 1906 "a bunch of Government Engineers" were again busily engaged near Grand Bend making preliminary surveys for more works intended to "give a better outlet to the waters of Lake Smith and other streams". By this time the inhabitants had apparently developed a healthy scepticism with regard to the result of these efforts. This attitude was not unjustified for "the Klondyke people" continued to be "flooded out" from time to time, if the ice was not successfully out of the "Cut" at the breakup.

Spring floods came to be accepted as natural and the fertile silt which they deposit is welcome to the landowners. Measures can be taken to prepare for them and lessen the amount of damage. But flash floods such as that reported at Parkhill on May 24, 1945, or that of July 15, 1947, are another matter. Only control measures which include the whole watershed can lessen the probability of flood damage on the low lands near the mouth of the river.

The "Cut" was cleaned out and enlarged in 1922 and the river dredged above Grand Bend in 1928. These measures caused a temporary improvement at the best and some method of controlling run-off higher up is evidently needed to relieve the situation in the "Klondyke" area.

Information about floods on the upper waters of the Ausable is more scanty and indirect. There are sufficient indications that they occurred as early and as often as on the neighbouring rivers. But unless the floods took place near an inhabited place of some size, or happened to interrupt the journey of some diarist or letter-writer, they usually went unrecorded in the early stages of settlement.

After the advent of the railways, the damage to roads became less important and it is noticeable that the concern of the public about floods has steadily increased since motor traffic and surfaced highways have become common.

Except at harvest time, the flooding of farm property was of little interest to any but the owners, unless buildings or a large quantity of stock were destroyed. On the Upper Ausable, buildings were not often exposed though they might be cut off from the road in some localities[1]. Damage to mills or villages however was "news" and is more often reported. We are told that the two lots in North Exeter, through which the river flows, were long left vacant because they were often under water for a considerable time. Damage to bridges is occasionally indicated, though the layout of the main roads reduced the number of river crossings. Damage to mills is rarely mentioned, since the more important mills were mostly on smaller streams, where the freshet was less severe.

Few of the villages[2] were exposed to flooding, and apart from the Grand Bend area, our information about floods comes from Exeter and Parkhill. The flooding in these villages was an annoyance rather than a danger. The branch of the Parkhill Creek, which flows through the village, is very small, but it none-the-less manages to flood an area of the town pretty regularly, the foundry and the neighbouring houses often having a foot or two of water over the lower floor. The railway embankment may possibly be partly responsible for the extent of the flood in this case. At Exeter, very few buildings were ever exposed to the freshet and since there was no great quantity of ice at the breakup the damage was limited to more or less water in a few base-

---

1. Particularly in part of the fourth concession of Biddulph.
2. Their sites were probably chosen with floods in mind.

goons and small inland
kes formed by the
eandering river

ments. Here, however, the flooding of the road was a serious matter since it blocked the London-Goderich highway and cut off the villages of "Francistown" and Exeter from each other. This sometimes occurred for a short time, and we also hear of flooding of the road near "Cameron's Siding", which delayed the mail for a few days.

From the building of the Arkona Power Dam at Rock Glen the inhabitants of Arkona took an active interest in the breakup of the ice, and often assembled at the dam to watch it go out[1]. On February 2nd, 1911, "a bee was held at Rock Glen for the purpose of cutting the ice and letting it away ----- that evening ----- the ice went out without serious damage[2]". This interest in the breakup went on until the dam went out of use[3]

Evidence of flooding on the Ausable can be found in the local newspapers for 1885, 1894, 1900, 1901, 1910, 1911 and, possibly, for 1905 and 1919 or 20, and it is clear that this list is far from complete, even for the thirty-five or forty years covered. Earlier files of these papers would probably produce a similar list of references. In 1934 damage to buildings at Port Franks was caused by bank erosion resulting from an ice jam which formed after a freshet in January. The flood of April 1937 was a serious one. The small stream at Parkhill rose nearly to the height of the railway viaduct and a jam of debris formed at the iron bridge north of the town. Roads were flooded in McGillivray, Stephen and Williams West. Highway No. 7 west of Sylvan was four feet under water and the bridge there was shifted three

---

1. Forest Standard, March 10th, 1910, et al.
2. Forest Standard, February 9th, 1911.
3. The dam was blown up by the Government in 1933 to allow free passage to fish. It had then been disused for some time.

inches by the flood [1]. In May 1945 Parkhill was flooded again. Stores were undermined, streets washed out and the foundry flooded. Highway No. 81 from Parkhill to Strathroy was under water in many places [2].

The flood of 1947 was serious all over the watershed. Parkhill suffered once more. Highway No. 7 was undermined near Sylvan. Roads and culverts were washed away in the Parkhill neighbourhood. The Pinery Road (No. 21) south of Grand Bend had to be closed when the bridge over the "Cut" was damaged. There was also flooding, which closed this road between Port Franks and Ipperwash though only part of this was caused by tributaries of the Ausable. In the upper part of the watershed, Highway No. 83 was overflowed "several feet deep", and closed to traffic. The highway at Exeter was flooded but not so seriously and there was flooding at Crediton and on the tributaries over a wide area. The bank of the river was washed away at Port Franks and six cottages damaged [3].

3. Physical Features Affecting Floods:-

(a) Soil Slopes, Soil Types and Soil Conditions:-

The surface slopes drained by the Ausable, Parkhill Creek and their tributaries have a fairly high gradient. The general slope to Lake Huron for the upper part of the watershed is in a southwesterly direction; for the lower part, in a northwesterly direction. The part of the watershed between Lake Huron and a line through Arkona, Parkhill and Mount Carmel has an average slope of about 28 feet to the mile, or .53 per cent. Figures showing the slopes for the watershed will be found in the chapter on Land Use in this report. The rapid run-off from this area was blocked by the

---

1. Parkhill Gazette, April 29th, 1937.
2. Ibid. May 24th, 1945.
3. Parkhill Gazette and Exeter Times, April 10th, 1947.

sand hills and forced to spread out over the "Flats", until it could find its way through them to the lake.

In conjunction with slope, the nature of the ground surface, resulting from the type of soil, plays an important part in determining the amount of run-off. The rate varies from that from rock, (which is, of course, the maximum) through those from impervious clay, mixtures of clay and sand, sand, gravel and finally that from catchment basins, such as swamps, swales and lakes, which have the minimum of run-off, unless already full of water. The Ausable Watershed has a high percentage of less absorbent soils - 74.2 per cent of the total drainage area of 665.4 square miles. In the section above Springbank, the percentage is 83 per cent. This high percentage of heavy soils together with the somewhat steep slopes produces a quick run-off which is a major factor in causing floods. This condition may often be greatly improved by contour ploughing and strip-cropping which would also save the loss of much top soil.

The condition of the soil at the time of rainfall also affects run-off. If it is frozen or saturated, the rate of run-off will be greatly increased. If there is ice, the rate would approach that from rock. On the other hand, when summer rain follows a period of drought, the rain is at first absorbed by the soil until saturation is reached. After that the run-off would be about as great as that from rock or frozen ground.

(b) Forest Cover and Catchment Areas:

The extent of forest cover has an important effect on the natural water storage capacity of any area, especially on impermeable soils. The extra storage capacity provided by the "forest floor", undoubtedly tends to equalize run-off to some extent throughout the year, maintaining summer flow in most cases and reducing the suddenness and velocity of floods, and thus limiting their destructiveness.

How far forest cover limits the volume of floods is more difficult to determine, since great floods have occurred and still do occur in areas which are more than ninety per cent wooded. Forests retard the melting of snow and ice and should they hold the snow until heavy spring rains occur at the same time as a sudden thaw, the result is a greatly increased run-off, which sometimes causes floods of greater magnitude than usual[1]. However, such a combination of flood conditions is somewhat exceptional and such risks can be provided for by adequate flood control measures with the proper balance of forest cover which is in keeping with good conservation practices. The increase of forest cover in the watershed from the present 77 square miles to the 108 square miles recommended in the Forestry Chapter of this report, would improve flood conditions rather than the reverse.

Catchment areas were once numerous in the Ausable Watershed, and formed an important source of water supply for many of the tributaries. The only lake in the watershed was Lake Burwell, now drained except for a small remnant known as Lake Smith. This lake, with its surrounding area of marsh and cranberry swamp, can hardly be regarded as a catchment area, but swamps and swales were once common - some of them of large size. Much of the centre of Hay Township was covered by swamp in 1856 and one third of the township was reported as swampy in 1881. A large area of swamp still exists in Hay and, being close to the headwaters, is ideally situated for summer flow. A reservoir at this site could be used both to increase flow in dry seasons and to some extent to retard run-off in flood time. Stephen also had large areas of swamp (38 per cent in 1881) which have been drained to a great extent, and this is the case with

---

1. This is recorded to have occurred more than once on the Thames.

the smaller scattered areas in some of the other townships[1]. The "black ash swales" characteristic of areas of heavy soils, were very common on the watershed, and in many cases, dried up after being cleared, without any artificial drainage. The effect of the disappearance of these surface storage areas on summer flow is discussed below. They must originally have had an effect on floods by retarding run-off, but after prolonged wet weather when the swamps and swales were full, the run-off from these areas would be retarded very little, if at all. Under-drainage, and especially tile drainage, must have increased the rate of run-off, but in many parts of the watershed it was an essential agricultural improvement, and in any case, chiefly affected the central part of the watershed since swamps were less common in the northern and southern parts.

4. Causes of Floods:-

Summarizing the preceding remarks, it is seen that the rapid run-off for the watershed, except for the disputed question of artificial drainage, is due entirely to the physical characteristics provided by nature. Except for the Hay Swamp there are now no natural physical features to retard run-off or conserve precipitation. The slopes to the tributaries and to the river itself are fairly heavy over much of the watershed with the result that flood waters have always surged out into Lake Huron carrying rich top soil with them to enrich the "Flats" and are lost for any useful purpose.

Ice jams at the mouth of the river and high lake levels also contribute to floods and are discussed more fully later in this report.

5. Low Flow:-

A writer of 1858 gives the following description

---

1. A "wet" area presumably existed east of the village of Centralia, since the London Road was diverted to the west before 1846, long before the village site was laid out in 1870.

of the river:

"The Sable ----- drains a large extent of the County (Huron), but it is only an indifferent, unattractive stream, insofar as size or scenery are concerned. There are a few spots where the current is pretty rapid, and where tolerable mill privileges are secured. But, in general, it is a dull, dirty, sluggish stream, crawling with a motion scarcely visible, between low mud banks, which in many places give it more the appearance of a stagnant frog pond than of a woodland river -----".

The description is too highly coloured and does not apply to all of the river, but it has a recognizable element of truth. The sluggishness was due to low gradient in long stretches of the river and the dirtiness and "mud" banks chiefly to bank erosion during floods, but the difficulty of finding mill sites was complicated even then by the regular shortage of water in many of the streams, some of which dried up completely in dry summers. In some places a good fall and reliable flow could be found at the same spot and groups of mills were built at the best of these, which were either far up the river or on spring-fed tributaries, such as the "River Lyon" at Carlisle or the streams which fall into the "Gorge" at Bartlett's Mill and Rock Glen[1]. The most important mills actually on the main river were at Exeter. It is possible that even these were sometimes seasonal in their operation and this probably was the case with the three or four grist mills between Exeter and Ailsa Craig in the sixties. From the source just quoted, we learn that in 1858 "the scarcity of sawed lumber in past years" in the area was due to many sawmills being too small and others "on the streams which were dried up or frozen up several months of the year"[2]. At this date, although more than 60 per cent of the watershed was still wooded, settlement had made considerable progress and there were some fairly large cleared areas. But it was even

---

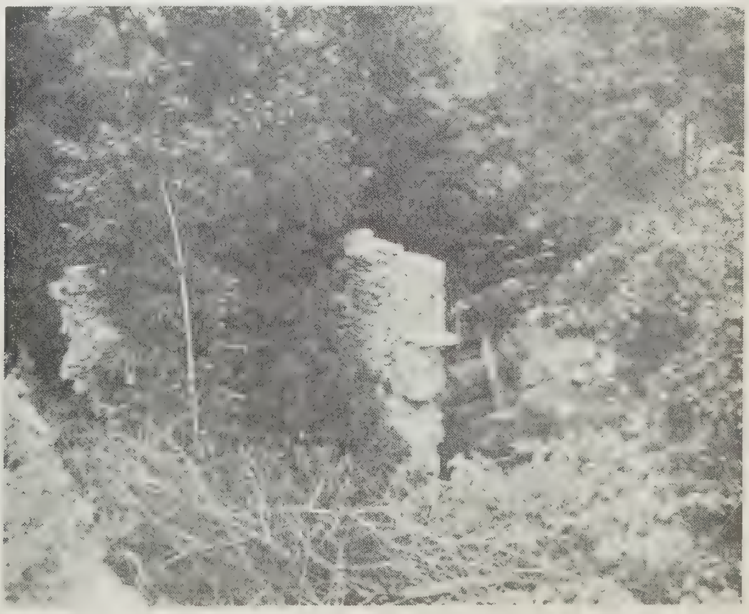
1. There were mills at all these points by 1846.

2. Transactions of the Board of Agriculture, 1858.

Foundry at Parkhill. The marks of frequent flooding can be seen on the lower walls.

Cottage undermined by Ausable at Port Franks.

The Little Ausable near Clandeboye "Teetotal dry" September 10th, 1947, as in August, 1843. Looking up stream from the Highway to the old bridge on the "London Road". The channel has been straightened.



Ruins of mill at Rock Glen near Arkona. There was a grist mill here in 1846.

then no new thing for mills to be short of water in summer. More than fifteen years before, in 1841, a traveller visited the new mills near Clandeboye in late summer and reported that "the supply of water was not sufficient for the constant working of the machinery [1]". Two years later, in 1843, the Little Ausable was found to be "teetotal dry" at near the same place by a traveller on the London Road.

It is not surprising that steam power was introduced very early and that there were probably more steam grist mills and sawmills on the Ausable in 1860 than on the Humber, although that area was much more accessible and more advanced. Sawmills could be run profitably on a seasonal basis [2] and some water-driven sawmills continued to operate for a long time, but it was a different matter with flour mills and woollen factories and as time went on more and more of these changed over to steam.

Low summer flow then, is of long standing on the Ausable, but there can be no doubt that the situation has grown steadily worse since the country began to be opened up. Dr. Dunlop, in his enthusiastic description of the area, remarked that there were enough streams "for every farm to be furnished with a share of one", but added "-----it is to be expected that in the course of cultivation many of these will be greatly impaired or perhaps totally dried up -----". This has certainly been the case, and a large proportion of the smaller streams in the watershed now dry up in summer completely, or in part. The Little Ausable was as "teetotal dry" near Clandeboye in September 1947 as in August 1843. Even some of the permanent streams are often reduced to a mere

---

1. Canada Company Pamphlet, 1846. This sawmill appears on the Canada Company Map of 1849, but not on a map of 1846.

2. The late summer was a slack time in any case, and the rush of work came in the spring with the floods. There were several sawmills on Moray Creek.

trickle of water, of little use for any purpose.

The headwaters of the main river, and of Black Creek, are fed by springs, but in the central part of the area many of the streams drew a large part of their water from swamp areas or swales. There were still some thousands of acres of swamp in Usborne, McGillivray and Biddulph in 1881, although the total was much lower than in Hay and Stephen Townships, where there was little under-drainage[1]. The spread of tile drainage and heavier lumbering in the next thirty years must have greatly reduced these areas of surface water storage, on which many of the streams depended for their flow. It was because of this dependence on the overflow of swamps and swales, which failed or was reduced in dry summers, that these streams were sometimes unreliable in early days. The complete drainage of these areas would naturally aggravate this situation, since it substituted a quick run-off of surface water for the more gradual overflow of the catchment areas. Whether it has also had an effect on the water table is difficult to estimate with the available data, but there are some indications that this may be the case, in some areas at least.

Further study of the problem of water supply and a good programme for the protection of source areas could do a great deal to improve the summer flow, though it could not be expected to make every creek clear, cold and permanent. The lack of good streams may be no serious handicap to farmers in the area at present, since other sources of water supply are usually available. However, a running stream in a pasture is always a desirable asset and sluggish trickles and standing

---

1. Under-drainage was not uncommon in the first three townships by 1881, but the proportion of tile drainage was still low. There were 965 acres of swamps reported from Williams West, and none from Williams East. Ontario Agricultural Commission Report, 1881.

pools may become a menace to health even in an area without large towns.

The protection of source areas and the control of floods, would be of great benefit to the Ausable region as to any part of the Province.

CHAPTER 2

GROUND WATER

1. General :-

No consideration of river valley development or of conservation or of re-development of agricultural areas could be adequate or in any way complete without some mention of that water which occurs beneath the surface of the earth, and particularly of that part of the sub-surface water that is within the zone of saturation, the ground water. For it is this water that is primarily responsible for the continued flow of surface streams and that supplies, to a very great extent, our domestic and industrial needs.

The water of the earth may be divided into three:

(1) Water in the atmosphere.

(2) Water on the surface of the earth.

(3) Water below the surface of the earth.

The water below the surface may in turn be divided into three:

(a) That above the zone of saturation.

(b) That in the zone of saturation.

(c) That in the interior of the earth.

The water in the atmosphere is perhaps primarily the concern of the meteorologist; that on the surface, of the hydraulic engineer; but that below the surface is directly the concern of the geologist, the agriculturalist, and the engineer.

There is, in general, an upper limit within the earth's crust below which the permeable rocks are saturated; this upper limit is called the water table and it forms the surface of the zone of saturation. The water within this zone is the ground water.

Practically all the water recovered from the zone of saturation, that is, ground water, is derived from the atmosphere. Most of it reaches the earth in the form of precipitation either as rain or snow. Of the precipitation falling on the ground, part is immediately carried away by streams as surface run-off, part evaporates either directly from the surface and from the upper mantle of soil, or by transpiration of plants, and the remainder sinks into the ground ultimately to be added to the ground-water supplies.

The proportion of the total precipitation that sinks into the ground will depend largely upon the type of soil or surface rock and the topography of the area upon which the moisture falls; if the surface deposits are of sand or gravel more water will sink in than if those deposits were of clay; if the region is hilly and dissected by numerous valleys more water will immediately drain away than if the surface is fairly flat and but little dissected. Steady precipitation over considerable periods will furnish more water to the ground-water supply than will torrential rains; in this case the run-off may be nearly equal to the total precipitation. Moisture falling after the ground surface is frozen will not usually find its way below the surface and therefore will not materially replenish the ground-water supply. Light rains falling during the growing season may be wholly absorbed by plants. The quantity of moisture lost by direct evaporation depends largely upon temperature, wind and humidity.

It is evident then, that the percentage of the total precipitation disposed of by run-off, evaporation, or percolation below the surface, is difficult to determine and depends to some extent upon local factors.

That part of the precipitation that sinks into the ground finds its way downward until it reaches the ground-water level or until it comes into contact with a layer of rock which is impervious to its passage; such a layer may hold the water some distance above the general ground-water level. This is known as perched water. If the ground-water level is at or near the surface there will be a lake or swamp; if it is cut by a valley, there will be a stream.

The conditions under which ground water occurs and the factors determining its quantity, quality, and possible recovery are many. This water is directly associated with the rock into which it percolates and as this rock may (and in Southwestern Ontario does) vary in its physical properties from place to place, so will the conditions affecting the ground water change.

Because of the large quantities of water that are daily consumed from underground sources, it may be thought that precipitation cannot furnish the entire supply. However, when it is remembered that a layer of water one inch deep over an area of one square mile amounts to about 14,520,000 gallons and that, in Southwestern Ontario the annual precipitation is perhaps in the order of 30 inches, it will be seen that over 420,000,000 gallons fall on each square mile each year. If we estimate that only 10 to 20 per cent; (surely a conservative estimate) of the annual precipitation reaches the zone of saturation there is still an appreciable quantity of water available to recharge the ground-water supplies.

It is not implied that the ground-water supplies are inexhaustible. So long as the annual recharge, that is, the quantity of water reaching the zone of saturation is equal to or greater than the quantity withdrawn, the ground-water supplies will not materially decline. Unfortunately,

however, there are parts of Southwestern Ontario where this condition does not prevail. It is common knowledge that once permanent streams are now dry, that many springs have disappeared and many wells have failed. Such a condition is in large measure the result of cutting down of forest trees, draining of swamps, and bringing into cultivation areas that perhaps should have been left as wood lots. In general, the same quantity of moisture is falling now as before the streams ceased flowing, but, so far as ground water is concerned one of the most important results of the aforementioned conditions is the great increase in surface run-off, culminating all too often in disastrous floods and reducing greatly the quantity of water that formerly went to recharge the sub-surface supplies. Couple with this the increase in population with its ever increasing demand upon ground water for both domestic and industrial needs, and it is not difficult to see that the ground-water resources will still further decline unless some remedial measures are taken.

Getting back to the geology of ground water; all sedimentary rocks are to some degree porous; that is, they possess pores between the individual grains of which they are composed. Water stored within the rocks mainly occurs as filling these spaces. A very fine-grained rock containing water may have such small pores that the attraction between the rock and water is great enough to hold the water in the rock; such a rock will not yield its water to wells. Those rocks that yield their water readily are called aquifers; those that do not are impervious beds.

For the present purpose the geology of Southwestern Ontario may be divided into two parts; the bedrock and the overlying unconsolidated glacial deposits.

The bedrock consists of layers of limestone, shale, and sandstone that when viewed at an isolated out-

crop generally appear to be flat-lying but that, regionally, are known to dip from 10 to perhaps 40 or 50 feet a mile in a general southwesterly direction. These rocks are sedimentary in origin, having been formed from sediments deposited in bodies of sea-water, later to be consolidated into hard rock.

The water-bearing properties of the various types of rock constituting this sedimentary succession vary greatly. In general, the shales, being fine-grained, are the poorest aquifers while the sandstones and limestones are considerably better.

No special study of the water in these rocks has been made, but they have been mapped over much of Southwestern Ontario so that the distribution, thickness, and general physical characters of the several formations are fairly well known. In the area bordering Lake Erie, the bedrock has been penetrated to various depths by wells drilled for oil and gas and a study of these drilling records has yielded some general data regarding water. Thus it is that we know of occurrences of fresh water generally in the upper part of the bedrock; of sulphur water somewhat lower; and of salt water at still lower depths.

Overlying the bedrock is the glacial drift. During the final stages of geological history great accumulations of ice formed at several centres in Northern Canada. Due to the pressure exerted by the immense thickness of ice, the ice moved out in all directions from these centres, covering large areas with a continental ice sheet. As the ice advanced it picked up great quantities of loose rock which it carried along and which was deposited when the ice finally retreated by melting. This material is unconsolidated and called glacial drift. Several advances and retreats of the ice sheet took place and each retreat left its accumulation of drift on the surface over which it

passed.

Thus, over most of Southwestern Ontario the bedrock is covered with drift ranging in thickness from zero in parts of the Bruce Peninsula to over 600 feet in the region north of Toronto.

Generally, the drift consists of boulders and pebbles of various composition and size embedded in a matrix of clay to form a more or less impervious mass called boulder clay. Intermingled with this and commonly in a most complex manner, and also lying above, below, and between successive till sheets are beds, lenses and pockets of water-laid sand and gravel which form the chief water-bearing members of the drift.

Throughout the greater part of Southwestern Ontario most of the ground water supplies are directly associated with the glacial drift.

2. Huron County:-

The mantle of Huron County is believed to be of reasonable thickness so that the possibility of there being deposits of water-containing sands and gravels within it or at the base is likely in most areas. Clay moraines of the Horse-shoe moraine extend through the western part and an area of drumlins north of Blyth continues north and northeast beyond the county to Meaford. The shorelines of glacial Lake Whittlesey extend from the southern part of the county up along the Lake Huron slope, and the shorelines of glacial Lake Warren also extend north and south through the western part of the county. Presumably there are deposits of outwash sand and gravel associated with the clay moraines, and deposits of sand and gravel along the shores of the glacial lakes. Deltas formed in glacial Lake Warren at Goderich and Bayfield by the Maitland and Bayfield Rivers respectively, may constitute favourable sources of ground-water supply for those vicinities.

Bayfield, Lucknow, Zurich, Clinton, Seaforth and

Wingham secured community supplies from wells. Exeter is dependent upon springs. The Seaforth and Clinton wells are in bedrock and the water is believed to come from the Norfolk (Onondaga). The wells at Seaforth are 240 feet deep and those at Clinton 350 feet. The mantle at these locations is comparatively thin, being but 70 feet. The water of the other communities named is drawn from the mantle, and except in the case of Bayfield is thought to be of glaciofluvial origin.

But little was learned with regard to ground-water conditions and problems in this county. It was reported that in the drought of 1944-45 there were many complaints about wells going dry in rural areas, and some of these were stated to have been drilled into the bedrock. The areas affected seem to have been particularly in Ashfield Township north of Lucknow. This section is poor agriculturally since it is relatively flat and poorly drained. It is believed, however, that most of the shortage affected shallow dug wells.

A ground-water matter of interest, although not an immediate problem, is believed to be a study of the ground-water resources of the acquifer supplying Clinton and Seaforth. It would be desirable also to make a somewhat detailed study of the pleistocene of the county, but this also can wait for a convenient time.

3. Lambton County:-

The pleistocene of this county is marked by the Wyoming moraine, extending from the northeast and becoming inconspicuous west of Petrolia. Apparently there are also several low-lying offshoots. Another feature of note is the number of beach ridges formed in glacial lakes, between Alvinston and Arkona. Finally, there is a blanket of sand formed in the glacial lake by waters poured from a river corresponding in position to the present Thames. Kettle Point shale is at the top of the bedrock throughout the county.

The Wyoming moraine and its branches are said to be good water producers, so that it is seldom necessary to go deeper than 12 to 18 feet in order to obtain a good supply of water in that area. Elsewhere in the county the drilled wells usually go to rock, a distance stated to be 60 to 80 feet. The occurrence of salty or sulphurous water in these wells is not reported to be a problem, leading one to believe that they do not go far into the bedrock.

An area east of Courtright is one which is reported to have experienced some difficulty in obtaining ground-water supplies. There was much water-hauling during the 1944-45 drought, in the vicinity of Petrolia. That community gets water from Lake Huron, an indication of the difficulty of obtaining good ground-water supplies in any quantity. Oil Springs has a privately-owned spring from which water is hauled and peddled. Many ponds are said to have been dug recently, in order to conserve well supplies. Many seepages are reported along Bear Creek, which runs through Petrolia, and springs at the headwaters. This water is presumed to come from the lacustrine sands of the glacial lakes.

Forest and Watford have sub-surface supplies. The Watford well, about 20 years old, is 105 feet deep and 2 feet into shale. The water is said to be satisfactory, although somewhat sulphurous. The wells at Forest are 140-150 feet deep and 48-57 feet into shale. The water is said to come from the top of the rock, the wells having been drilled into the shale to provide room for an air lift. The water stands at a level 90-110 feet from the surface, and is said to have risen within 16 feet of the surface when the first well was drilled. It is notable that this supply is not salty, even though the bottom of the well is considerably into the rock. Rural wells in surrounding country were said to have been affected by the installation of these Forest wells. The wells are not pumped beyond 50 gallons per minute, as otherwise clay

is said to be drawn in.

Information regarding the occurrence of ground water in this county is comparatively limited. It is obviously advisable to work toward securing more complete data, particularly for the areas which have reported difficulty.

4. Middlesex County:-

The mantle of this county is prevailingly thick, generally, so that in rural areas satisfactory water supplies, may be secured from within or at the base of the drift. Most of the county is ground moraine, but there are several clay moraines of the Horseshoe moraine, and there are valley trains between and at the ends of these moraines. The deposits of sand and gravel on the surface, formed by glacial waters along spillways and outlets, are favourable for ground-water accumulation. No water-supply problems in rural areas during recent periods of drought, except possibly in the vicinity of Melbourne, are reported. Here, as elsewhere, shallow wells, particularly in till, have failed in time of drought. No difficulty in securing water in drilled wells is reported, although wells drilled into bedrock are always confronted with the possibility of striking salty water.

Several communities in this county depend upon sub-surface supplies. These include London, Strathroy, Glencoe, Lambeth and Parkhill, and the water in each case is believed to come from sands and gravels in the drift. The wells at Strathroy are only 30 feet deep and those at Glencoe have a maximum depth of 147 feet. The smaller wells at Strathroy are thought to be located in a valley-train deposit. Strathroy was not visited, but according to report there is no difficulty in the bringing in of new wells through the use of sand-points. So far as known, all of these supplies are reasonably potable, except the one at Parkhill which is reported to be sulphurous in character.

Ground-water resources in the vicinity of London

are a subject of controversy. Originally the city supply came from springs located within the city in Springbank Park on the south side of the Thames River. These springs were developed to their maximum, the water gathering in collecting basins at the base of the terrace on the south side of the valley. Many years ago as this spring supply became insufficient, the city committed itself to a programme of well development. At present there are about 32 wells ranging from 90 to 130 feet in depth, located in and near the city, most of them in the valley of the Thames River or nearby on adjacent terraces. In addition, many test holes have been drilled and many wells formerly in use have been abandoned. As the need for more water arises, more wells are drilled. The city has the advantage of being the location of the office of the International Water Supply Company, which works in close co-operation with the city administration. In the summer of 1945 additional wells were being drilled on the flood-plain north of the city. The city had also gone to the vicinity of Lambeth, to the south, to augment its supplies.

It has been reported that there is a likelihood of water shortages developing. The city authorities explain that any shortage which seemed likely to develop over the past few years has been related to the impossibility of getting labour and materials for the drilling of new wells. Controversy has also been around in connection with the claim that the installation of wells and the excessive production from them has seriously affected smaller wells of home owners and farmers.

The surface bedrock of most of the county is the Hamilton formation, mostly shale and a smaller amount of limestone, in the western part, and the Norfolk formation composed of magnesium and calcareous limestones in the eastern part. Presumably, as elsewhere, freshwater supplies from the fissures near the top of these formations may with luck produce potable

water. Non-potable water is a great possibility, particularly if the wells go to any depth in the bedrock. One flowing well at the west end of the Springbank Park, believed to have been drilled into the bedrock, produces a highly sulphurous water.

For the time being there seems to be little need of detailed study of the ground-water geology in rural areas or in any of the towns of this county using well or spring water except London. With its present population of 82,000 and further growth in prospect, it would seem logical that as complete knowledge as possible with regard to the ground-water resources in the vicinity be developed. A thorough and detailed study of the pleistocene in this vicinity is first in order, so that the extent and relations of all water-bearing sand and gravel deposits may be learned. Inspection of the well records of the International Water Supply Company and the Public Utilities Commission of London should contribute to this study. All subsequent testing and drilling should be closely followed. International Water Supply Company and London city officials may have great faith in their ability to continue increasing their supplies from sub-surface sources, but it is believed they would benefit greatly from geological study and advice.

5. Perth County:-

In spite of the fact that Perth is covered with a variety of glacial deposits, wells drilled to or into the bedrock are reported to be widespread and numerous. This suggests either that the drift is thin at least in some places, or that it is poor in available ground water, or that supplies from the bedrock are better. The glacial deposits include clay moraines, which are part of the Horseshoe moraine, and sand moraines, also ground moraine and valley trains. The valley trains are of course along the principal natural drainage lines and in some cases connecting them. Eskars are a prominent feature in Elma Township. A drumlin area extends

north from Listowel.

No difficulty appears to have been experienced as regards sub-surface supplies in the rural areas, although as stated it is notable that wells are drilled into bedrock, many of them as much as 180 or 200 feet in depth. In the vicinity of Mitchell, the rural wells are reported to go to the bedrock, at an approximate depth of 75 feet, where they strike good water. Practice is to case off sand and gravel acquifers in the mantle because water from these sources is likely to contain troublesome silt or fine sand. The mantle is reported to be approximately 75 feet thick at Listowel, where a plentiful amount of water under pressure is found at the top of the bedrock. Wells in the vicinity of Stratford are also reported to secure their water from the bedrock.

Stratford, St. Mary's, Listowel, Mitchell and Milverton have supplies from springs or wells. That for the first two of these apparently comes from limestone (Onondaga) of the Norfolk formation. The artesian well at St. Mary's has a depth of 150 feet, and Stratford has six wells ranging in depth between 550 and 650 feet; these wells penetrate 100 to 125 feet of mantle. The Stratford supply apparently is ample, but the city officials are at present (September 1945) concerned as to the possibility of contamination of the water supply by sewage from a veteran's settlement contemplated for an area just east of the city limits. According to reports, this community is to have individual septic tanks.

Listowel has three wells ranging in depth from 240 to 338 feet; the water is probably from the Akron-Bertie. The Milverton supply comes from the bedrock, either the Akron-Bertie or the Selina, and that of Mitchell from an acquifer in the drift.

There are believed to be no immediate ground-water problems in this county. The matter thought to be most in need of study when the time becomes available is that of

the ground-water resources of the bedrock. It would seem from the available evidence that the limestone of the Norfolk, and most of it is limestone of one sort or another, contains considerable fresh water, much of it obtained from wells within the formation. Its quality should be confirmed and the extent of the area from which suitable supplies might be drawn determined.

CHAPTER 3

HYDRAULICS

1. THE FLOOD PROBLEM:

1. Natural Conditions

The serious flood problem on the Ausable Watershed is confined to an area of approximately 6,920 acres situated in the low-lying land inshore from the sand dune area near the original mouth of the river. Three areas, which are usually considered separately, are the hamlet of Port Franks, the Thedford Flats, and the Klondyke area of which the Haig Farm forms a large part. A fourth area which is quite local is the town of Parkhill, ~~Village~~. This constitutes a nuisance flood and disrupts some industries for a short time but is not of the magnitude of the other three. Before dealing with these sections separately it would be well to review the history of this part of the watershed and particularly the natural features of the area before it came under cultivation.

The flats are believed to have been represented by a bay in the shore of a higher post-glacial stage of Lake Huron, which was cut off from the lake by a bar, which forms dunes along the present shore. This lagoon became practically filled with alluvial and peat deposits leaving what was originally Lake Burwell, approximately ten feet above the level of Lake Huron. The accompanying map (Fig. H-1) which is based on early surveys and supported by the memory of old settlers, shows the approximate position of Lake Burwell, as it was in relation to the present Lake Smith and as it is believed to have existed in pioneer times.

In addition to the large area occupied by Lake Burwell itself it will be seen that the area immediately surrounding the lake was marsh, thickly covered with aquatic plants, and beyond this was an extensive swamp forest composed of soft maple, elm, cedar, tamarack and willow. The whole area therefore was originally wild swamp flats merging


PLAN OF
LOWER AUSABLE RIVER
SHOWING
LAKE BURWELL & SURROUNDING SWAMP
ABOUT 1840
NATURAL FEATURES IN 1840
SWAMP
FOREST
SWAMP FOREST BOUNDARY
DEVELOPMENT SINCE 1840
CULTIVATED LAND
SCALE OF MILES
0
1
2
GRAND BEND
No.81 HIGHWAY
BREWSTER'S
AUSABLE RIVER
LAKE HURON
PINERY ROAD
KLONDYKE ROAD
SMITH
LAKE
LAKE BURWELL
No. 21 HIGHWAY
THE CUT
PORT
FRANKS
No.82 HIGHWAY

Ausable River at Port Frank.

The "Cut". Looking downstream into sandhills from Bluewater Highway Bridge.

The "Cut" upstream from Bluewater Highway. Start of sandhills with old Lake Burwell bed in the background.

The "Cut" Looking downstream from Melville's Bridge.

with the lake which was periodically covered by flood waters in spring and summer, as they debouched into this low-lying basin. Thus, this old flood area, like so many others on the rivers of Ontario, belonged by ancient right to the river, and by the gradual encroachment of farming, necessary and useful as it is, involves a project of protection which is difficult to solve, because in doing so, man is pitting himself against the powerful forces of nature. By this, it is not intended to imply that such flood problems cannot be solved, but it should be borne in mind that where nature in the form of large rivers is brought within bounds, the cost is usually excessive, and sometimes the money required to accomplish such control outweighs the benefits to be achieved. Where this is the case, some measure of relief can be achieved, but usually a compromise must be made amounting to half measures.

Because this part of the river valley was known to have flooded in early times to the extent that passage up the lower reaches was well-nigh impossible owing to the accumulation of debris in the Lake Burwell section, it can be truthfully stated that flooding of this area can be considered an act of God; and therefore, as far as these lands are concerned, the damage is comparable to that of hail in the western provinces and late and early frosts in the tobacco lands.

(2) Settlement and Drainage:

When it became known that these lands were desirable for agricultural purposes, drainage was undertaken on a large scale. First, in 1872-5, the Canada Company built a cut along its present course to Port Franks, thereby draining Lake Burwell and creating an area known as the Thedford Flats. This Cut diverted all the water from the main Ausable and allowed it to pour down directly to the old mouth of the river, seriously increasing flood hazards in the above village.

Head of "Cut". Old Ausable River bed overgrown in the background.

Old Ausable channel overgrown and no flow between the "Cut" and Parkhill Creek.

Junction of Parkhill Creek and Old Ausable River.

Old Ausable River at the Huron - Middlesex county line.

In 1892 another cut was made at the hairpin curve at Grand Bend, which together with the Cut made in 1875 virtually separated the Ausable River into two systems -- the main Ausable flowing directly into the lake at Port Franks and the Parkhill Creek and its tributaries flowing down the old channel to Grand Bend.

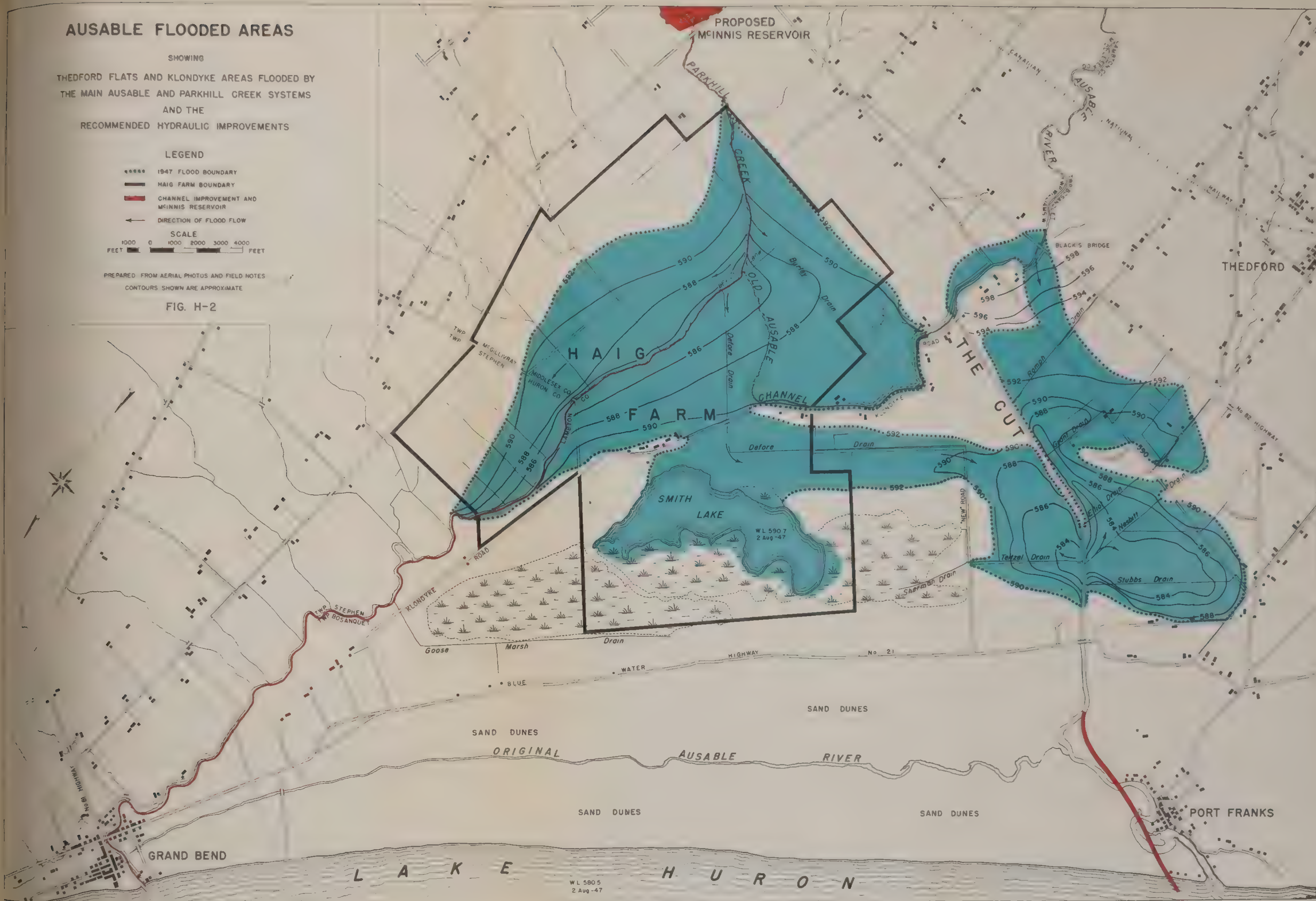
In addition to these two major Cuts other large drains have been excavated, not to mention the extensive tile drains on individual farms, which are essential in such flat low-lying land.

(3) The Flooded Areas: (Fig. H-2).

(a) The Thedford Flats.

This reclaimed marshland is very fertile and returns are high from specialized crops of celery, onions, root crops and peppermint. Of the 2,450 acres affected by the 1947 flood, 77 per cent (or 1,890 acres), is under this intensive cultivation. The remaining 560 acres would be suitable for the same crops if they were broken up.

The greatest damage is done in the old Lake Burwell area by summer flash floods. Breakup freshets are accepted as inevitable and even welcomed for the fertilizing effect of the silt deposited, as well as the supply of sub-soil moisture ensured. In addition, they occur before the ground is normally workable so that there is little loss of the farmer's time. The summer floods, although lower and less extensive, cause heavy losses to sown crops, making re-sowing or substitution of a quicker growing crop necessary. The 1947 June floods though only reaching an elevation of 585 feet, 5 feet above lake level at that time, covered 500 acres in the most heavily cultivated parts. It affected a large number of growers as part of this area is worked in 10 and 20 acre plots by villagers of Thedford and neighbouring farmers. An indication of the amount of possible loss is the fact that a grower may live in Thedford and derive his cash income from as little as 5 acres, returns varying from


AUSABLE FLOODED AREAS
SHOWING
THEDFORD FLATS AND KLONDYKE AREAS FLOODED BY
THE MAIN AUSABLE AND PARKHILL CREEK SYSTEMS
AND THE
RECOMMENDED HYDRAULIC IMPROVEMENTS
LEGEND
1947 FLOOD BOUNDARY
HAIG FARM BOUNDARY
CHANNEL IMPROVEMENT AND McINNIS RESERVOIR
DIRECTION OF FLOOD FLOW
SCALE
1000 0 1000 2000 3000 4000
FEET FEET
PREPARED FROM AERIAL PHOTOS AND FIELD NOTES
CONTOURS SHOWN ARE APPROXIMATE
FIG. H-2
PROPOSED McINNIS RESERVOIR
PARKHILL CREEK
AUSABLE RIVER
THEDFORD
BLACK'S BRIDGE
HAIG FARM
OLD AUSABLE CHANNEL
THE CUT
SMITH LAKE
W.L. 590.7 2 Aug-47
KLONDYKE ROAD
Goose Marsh Drain
HIGHWAY No. 21
BLUE WATER
SAND DUNES
ORIGINAL AUSABLE RIVER
PORT FRANKS
GRAND BEND
LAKE HURON
W.L. 580.5 2 Aug-47

$200 per acre for sugar beets to $2,000 per acre for dutch sets.

In the case of spring freshets, the water rises in the river channel south of the Canada Company Cut and overflows over a length of 1,500 feet at Black's Bridge in Lot 26/27, Concession I, Township of Williams West, flowing northwest and spreading west into the flats area, joining the water backed up the drainage ditches from the Cut. Of the remaining flow down the river, at the highest stage, not more than 20 per cent overflows down the old channel to the Klondyke Area, the balance flowing down the Cut. The Cut has sufficient capacity to contain the flow until the low ground of the Lake Burwell bed is reached and water backs up the drainage ditches onto the flats. North of the Cut, water backs up the Teitzel Drain to the road between Lots 20 and 21 and to the east end of that road. At this point the higher waters of the Haig Farm area back up the Defore Drain, overflow the road and make their way to the Cut.

Local variations of the flood pattern may be caused by ice jamming in the Cut but the typical behaviour is that described.

(b) <u>The Klondyke Area</u>

The Klondyke area consists of 7,500 acres, about half of which is under cultivation, on the old Ausable channel and lower Parkhill Creek - locally known as the "Ptsebe" - and includes the greater part of the flooded area of 4,470 acres or 7.59 square miles (1947).

With the exception of a small amount of water which overflows down the old Ausable channel from the head of the Cut, all the flood water comes from the "Ptsebe" system and two small creeks which empty into the old Ausable below the "Ptsebe".

Spring flood water reaches an elevation of 592 feet- 12 feet above Lake Huron and 2 feet above the flood water in the Thedford Flats area. The water first rises out of the channel near the junction of the "Ptsebe" and Old Ausable

and covers the flats on both sides of the river. To the west it backs up the Defore Drain, across the Klondyke Road, south of the Haig Farm office and spills into Smith Lake. Part flows to the south along the upper part of the Defore Drain and overflows the New Road between Lots 20/21 and makes its way to the Cut through the Teitzel Drain.

Summer floods as in the Thedford Flats are lower but equally costly. In June 1947, water rose to an elevation of 587 feet covering about 900 acres, most of which was in crop.

(c) Port Franks

Port Franks at the mouth of the river, as already stated, now bears the full burden of the waters of the main river as they come through the Canada Company Cut and force a tortuous and ever-changing course through the sand hills of the area. In recent years the damage to property in the village has been excessive, due largely to the severe bank erosion.

The problem of flooding in Port Franks is further accentuated by ice jams at the mouth of the river, which are built up by Lake Huron in the deeply silted sand flats where the river enters the lake.

(d) Parkhill Village

Flooding in Parkhill Village is caused by the waters of a small creek which drains an area of about 2,000 acres above the village. Most of this area is farmland with a few patches of woodland which provides easy run-off from the area. The creek extends three and one-half miles from the village to its source and in that distance the drop is 87 feet or approximately 26 feet per mile. This steep gradient is responsible more than anything else for the rapid accumulation of water in the village.

As already mentioned, the floods here are more of a nuisance than anything else and periodically flood the foundry and surrounding houses for short periods,sometimes

as high as three feet.

(4) Effect of Lake Huron Water Levels

The water levels of Lake Huron have varied over the years of record by as much as five feet. These variations in level are not sudden changes as might be caused by winds or seiches[1] but occur irregularly over the years. When considering measures to regulate the flow through the Thedford Flats and the Klondyke area to prevent flooding, because of the flat gradient in the channels and the slight difference in elevation between lake level and the ground elevations in the flats, such measures obviously must be based upon high levels of Lake Huron. The accompanying Chart (Fig. H-3) shows the variation of these levels over the years.

The maximum elevation on record for Lake Huron occurred in 1838 and was 583.78. The maximum monthly mean occurred in July 1876 and was 582.75. In recent years, however, considerable sand and gravel has been dredged from the foot of the Port Huron Rapids on the St. Clair River just below the outlet of the lake, which has resulted in the lowering of Lake Huron levels by a total amount of 0.6 feet. The following lake levels may, therefore be considered as more representative of the conditions as they now exist:

Maximum reading occurred:	July 1,	1929 ...	582.16
Maximum monthly mean:	July	1929 ...	581.40
Minimum monthly mean:	Feb.	1934 ...	576.51

The maximum monthly mean which occurred in July 1876, 582.75 less the 0.6 for dredging, as explained above, reduced this elevation to 582.15, which is in close agreement with 582.16, the maximum reading for July 1st. 1929.

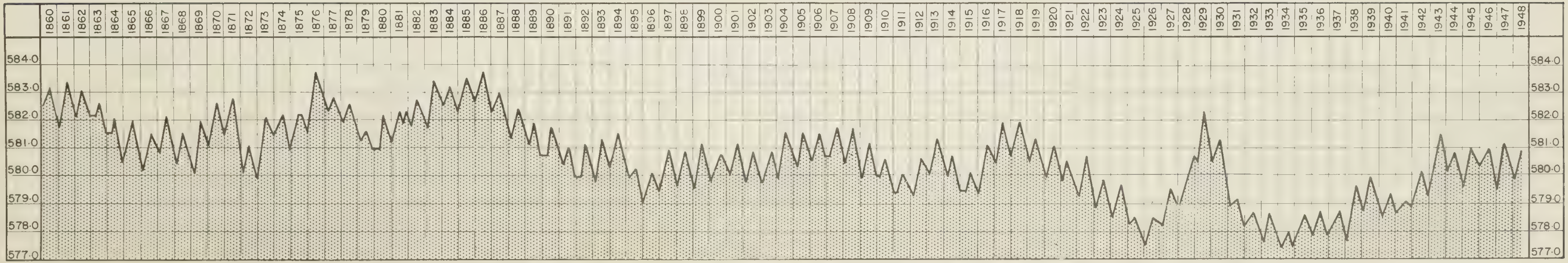
Agencies such as seiches and sustained strong winds may build up higher water elevations, but their effect is negligible in the channel flow calculations because the

1. Seiche: Changes in elevation of large bodies of water due to atmospheric pressure.

LAKE HURON WATER LEVELS 1860-1948.

MAXIMUM AND MINIMUM MONTHLY MEAN WATER SURFACE ELEVATIONS, ABOVE MEAN SEA LEVEL.

FROM RECORDS of PRECISE WATER LEVELS DIVISION, HYDROGRAPHIC SERVICE of CANADA, DEPARTMENT of MINES and RESOURCES



freeboard on the ditches should provide sufficient protection against wind and seiche action and it is not likely that these conditions would occur at the same time as flooding.

As seiches are due to a difference in atmospheric pressure on the surface of a large body of water, the water surface elevation in the low pressure area would be higher than that in the high pressure area. Their effect may be a matter of minutes or hours, and their amplitude from a few inches to several feet in some of the larger lakes. A seiche of 2.4 feet has been recorded at the outlet of Lake Huron.

The effect of wind action is usually greater, more frequent and of longer duration than seiches. Strong winds may build up the water level two or more feet over a period of several days.

The mean lake levels for the peak days of the spring and summer floods are as follows:

Spring floods:		Summer floods:	
January 6, 1916	578.98	October 7, 1945	579.81
January 31, 1916	578.57	May 26, 1947	579.63
March 29, 1916	578.64	June 8, 1947	579.80
March 24, 1917	579.75	July 28, 1947	580.29
March 8, 1946	579.59		
April 6, 1947	578.42		
March 20, 1948	578.98		

The lowest point recorded on the Thedford Flats is 582.6, which is only 0.44 feet (about half a foot) above the maximum lake level of 582.16, and it is evident that when lake levels are high the channel through the Thedford Flats will be practically full, leaving little room for the flood waters.

(5) Types of Floods:

(a) Spring Floods

Spring floods are the most severe as regards volume of water. At this time of the year, the ground is either sealed with frost or saturated with moisture and if the snowfall has been excessive, the volume of water coming down is correspondingly great. However, at this time of the year the lands which are subject to flooding are not in crop; and

ank erosion along Aus-
ble River at Port Frank.

while water becomes a nuisance and creates hardship in getting about, the entire damage is not so great to crop land as floods which occur during the summer months. Such spring floods, however, always carry a certain amount of silt which represents, for the most part, the top soil of the farmlands farther up the valley. Such floods are usually the cause of damage at Port Franks.

(b) Summer Flash Floods.

Floods of this type occur periodically during the early spring and summer after the crops have been sown, or later on before they are harvested. They are the result entirely of excessive rainfall over the watershed and in the case of the Ausable, two and one-half inches of continuous rain, depending upon the amount of moisture in the soil, will create a flood condition in the critical lands near the mouth of the river. In fact, the heavy loss of crops at this time of the year is responsible more than any other factor, for the urgency to solve the flood problem on the river.

(c) Unforeseen Floods.

In addition to the recorded spring floods and flash summer floods, there is also a likelihood that greater floods than have ever occurred on the river may occur in the future. In fact, it is common knowledge that damage from flooding of Ontario rivers is becoming more severe as time goes on. Because of this, it is good engineering practice when planning flood control works to anticipate what the greater floods will be, in order to give all possible protection and make such works sufficiently large to take care of floods which may occur once in fifty or better still, once in one hundred years.

In this report, the solution of the flood problem is concerned chiefly with spring and summer floods to the magnitude of those which occurred in 1947. Solution of those which might occur once in one hundred years and the

cost of providing for protection from these, are indicated but as will be shown later, the cost of such protection is too excessive.

2. THE SOLUTION OF THE PROBLEM:

(1) Introduction:

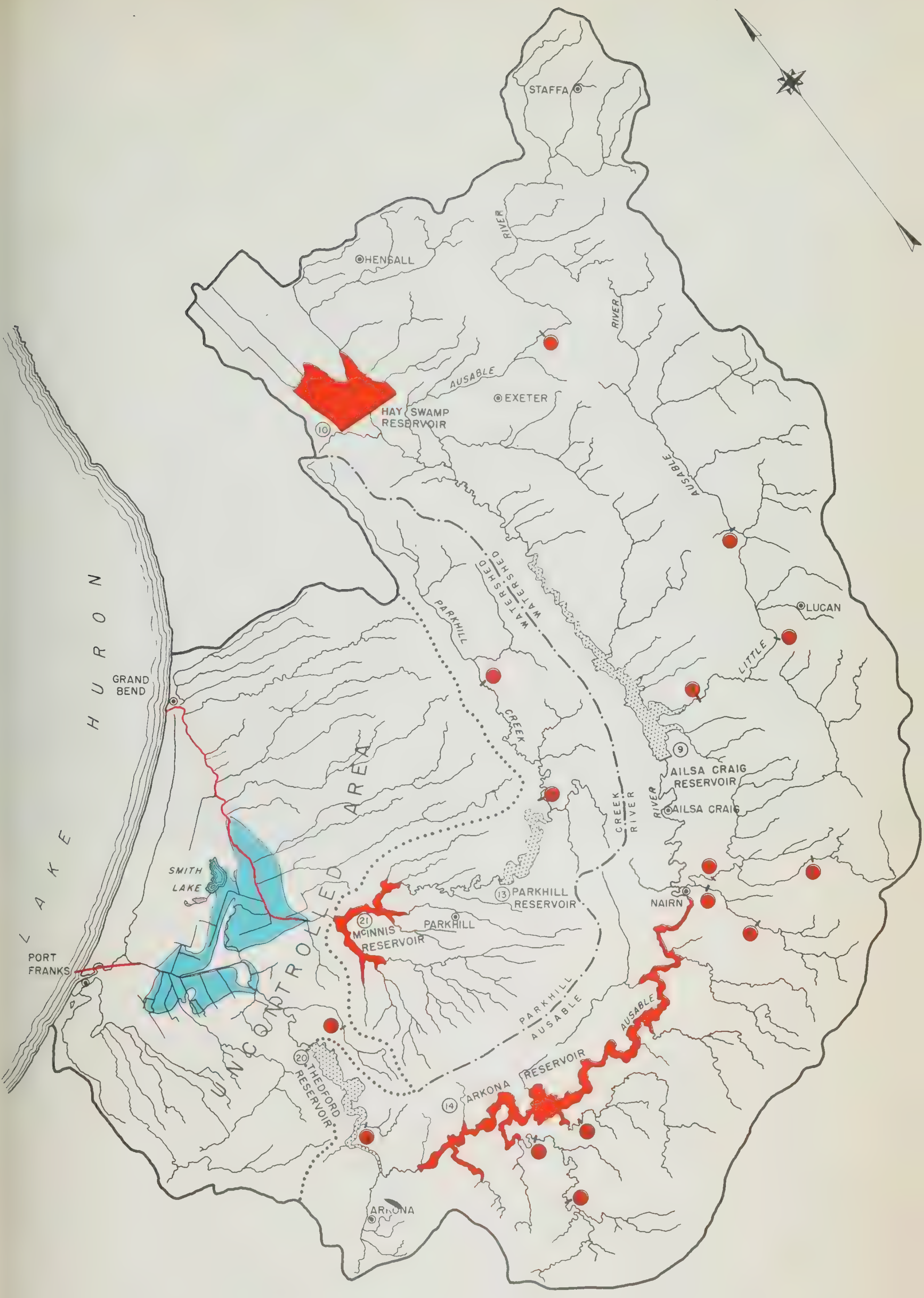
In approaching the problem of flood control on any river, certain recognized methods can be employed. These include conservation reservoirs, diversions or canals, channel improvement such as deepening and straightening a river or making a new river course, and the building of dykes. All are costly works and the one which is usually resorted to last is the building of dykes because of their expense which often involves the pumping of water from the protected area back into the channel.

Usually the problem can be solved by reservoirs but where the topography does not provide natural storage areas, other measures mentioned above must be used, and sometimes a combination of two or more and in extreme cases all four.

While usually in engineering reports it is considered sufficient to describe and give costs only of the scheme or schemes which, in the opinion of the engineers are feasible and therefore recommended, in this report it has been considered more satisfactory to describe briefly, with approximate costs, several ways in which flooding may be prevented.

As already mentioned in this chapter, the building of the Canada Company Cut virtually separated the waters of the Ausable into two systems which for the sake of clarity in this section will be referred to as the Main Ausable system and the Parkhill Creek system; and while there is some mingling of the waters of these two systems in the Old Lake Burwell region in periods of severe flooding, the two can be treated separately as far as the hydraulic problem is concerned.

Also by way of introduction it is necessary to explain two terms which will be met with frequently in the



AUSABLE WATERSHED

SHOWING

PROPOSED CHANNEL IMPROVEMENT & CONSERVATION RESERVOIRS

LEGEND

PROPOSED MAJOR RESERVOIRS AND CHANNEL IMPROVEMENTS
OTHER POSSIBLE MAJOR RESERVOIRS
POSSIBLE MINOR RESERVOIR DAMSITES NOT EXCEEDING 15 FEET IN HEIGHT
FLOODED AREAS

SCALE — MILES

2 0 2 4 6 8

FIG. H-4

Mosaic from aerial photographs showing the proposed channel improvements. Old Ausable River courses (centre-left and lower right) and the lower part of the "Cut" (upper left) may also be seen.

discussions which follow. The first of these is the term "acre feet". Liquids in small quantities are usually measured in terms of gallons, but when large quantities of water, such as are found in a lake or reservoir, say a mile or more in length, are being considered, the small unit namely a gallon, becomes too cumbersome because of the number of figures involved. Consequently the larger unit, acre feet is used. This means one foot of water covering one acre in area or its equivalent, regardless of its shape (43,560 cu.ft).

Water which is in motion, such as a stream, or water running through a channel, is measured by the number of cubic feet which pass a given point each second. This is expressed by the abbreviation c.f.s (cubic feet per second).

(2) Summary of Schemes

As several different schemes and combinations of these are described below, for the sake of clarity and reference a summary is stated here.

-------- A - MAIN AUSABLE SYSTEM --------

1. SUMMER FLOODS OF THE MAGNITUDE OF 1947
   (a) Lesser Port Franks Improvement Channel.
   (b) Arkona Dam (45 feet) and Reservoir.
2. SPRING FLOODS OF THE MAGNITUDE OF 1947
   (a) Greater Port Franks Improvement Channel.
   (b) Arkona Dam (60 feet) and Reservoir combined with Lesser Port Franks Improvement Channel.
   (c) Arkona Dam (68.5 feet) and Reservoir.

------- B - PARKHILL CREEK SYSTEM -------

1. SUMMER FLOODS OF THE MAGNITUDE OF 1947
   (a) Lesser Old River Bed Improvement.
   (b) McInnis Dam (26 feet) and Reservoir.
2. SPRING FLOODS OF THE MAGNITUDE OF 1947
   (a) Greater Old River Bed Improvement.
   (b) McInnis Dam (31 feet) and Reservoir and Parkhill Dam (29 feet) and Reservoir combined with Lesser Old River Bed Improvement.
   (c) McInnis Dam (31 feet) and Reservoir and Parkhill Dam (36 feet) and Reservoir.

(3) Schemes in detail

-------- A - MAIN AUSABLE SYSTEM --------

1. SUMMER FLOODS OF THE MAGNITUDE OF 1947

At normal Lake Huron levels, floods of this magnitude have a probable occurrence of once in twelve years for the summer months and every year during the spring break-up period. These schemes make no attempt to prevent the latter, although they would be lessened to some extent.

(a) Lesser Port Franks Improvement Channel

This scheme provides for an excavated channel about 8,000 feet in length with a 60 foot bottom width, graded to an uniform bottom elevation of 570 feet. Starting from a point on the Canada Company Cut approximately 3,300 feet west of the Blue Water Highway Bridge, it would cut off three loops in the river and enter Lake Huron at a point 2,000 feet north-east of the present river mouth (Fig. H-2). In order to maintain maximum flow in this new channel it would be necessary to extend the excavation out into the lake and this would have to be protected by retaining walls or jetties. This channel as described, together with the existing bends in the river which it cuts across, would have an approximate capacity of 6,250 c.f.s. (lake level 580.0 feet) and would be sufficient to prevent floods of this magnitude. It should be noted here that the bends, which are cut by the new channel, will be left open so that part of the flood water will flow around the bends and the remainder through the excavated cut. If the jetties were not built to protect the mouth of the channel, some provision would have to be made for clearing this out periodically by dredging or some other means and would

involve an expenditure annually of a few thousand dollars. If this were done then the cost of the jetties namely $167,396.00 could be deducted from the following estimate and the remaining work would cost approximately $109,000.00. This is essentially the scheme proposed by Col. S.W. Archibald in his report to the Authority dated September 20, 1948.

Estimated Cost

Breakwater	$167,396.00
Channel Improvement	109,000.00
Total Cost	$276,396.00

(b) Arkona Dam (45 feet) and Reservoir

As an alternative method to channel improvement, floods of this magnitude could be regulated by providing a flood storage reservoir equivalent to the increased flow (3,000 c.f.s.) of the above scheme. Seven thousand acre feet storage would be required, which would be available with a 45.0 foot dam and reservoir at Arkona (Fig. H-4). This Dam would be located in the rocky gorge two miles east of the village of Arkona (at road crossing Lot 22, Concessions VII and VIII, Williams W. Township). The reservoir extending easterly for 9.5 miles from the dam and covering an area of 420 acres and would have a maximum depth of 40 feet at the dam.

Estimated Cost	$382,500.00

2. SPRING FLOODS OF THE MAGNITUDE OF 1947

The 1947 spring flood had a peak flow of 10,800 c.f.s. at Port Franks. Floods of this magnitude have a probable occurrence of once in six years for the spring months and protection for these may

be obtained as follows:-

(a) Greater Port Franks Improvement Channel

To provide the required protection by this means it would be necessary to increase the channel capacity from 3,000 c.f.s. to 7,550 c.f.s. for the cut described under 1 (a) -(Archibald's). In order to obtain this discharge of 7,550 c.f.s. the channel would have to be enlarged to a bottom width of 180 feet and graded to a bottom elevation of 570.0 feet throughout its length. With this enlarged section, the channel plus the existing river loops would protect the Thedford Flats and Port Franks from flows up to 10,800 c.f.s. at lake levels up to and including 580.0 feet. With flows of this magnitude, jetties would have to be built.

Estimated Cost $763,248.00

(b) Arkona Dam (60 feet) and Reservoir combined with the Lesser Port Franks Improvement Channel

The lesser Port Franks Improvement Channel (Archibald's) would provide a total channel capacity flow of 6,250 c.f.s. and to keep the spring flood flow at Port Franks down to this level it is estimated that 20,000 acre feet of storage are required. Such storage could be had at several sites along the river, of which the Arkona site is believed to be the most suitable. A dam 60.0 feet high at this site, with a maximum water depth of 54.0 feet would provide the required storage. This would be an earth-filled controlled dam with a concrete spillway section and would be located in the rocky gorge about two miles east of the village of Arkona at the same location as described for 1 (b). From the proposed dam the reservoir extends easterly

and when full would be approximately 14 miles long with a surface area of 1060 acres.

Estimated cost	
Arkona Dam (60 feet) and Reservoir ...	$723,058.00
Lesser Port Franks Improvement Channel.	276,396.00
Total cost	$999,454.00

(c) Arkona Dam (68.5 feet) and Reservoir

To reduce the peak spring flow at Port Franks to the present channel capacity (3,250 c.f.s.) by means of storage only, would require a reservoir to impound 35,000 acre feet of water. This amount of storage could be had with a 68.5 foot dam at Arkona, located at the same site as above but the reservoir, when full, would extend easterly for 16 miles and have a surface area of 1,850 acres with an average width of 0.2 miles (1,056 feet).

Estimated cost	$1,010,624.00

------- B - PARKHILL CREEK SYSTEM -------

Means of regulating flood flows in this area would be the same as those employed on the Ausable River, namely by reservoirs and channel improvement. The flooding here is more extensive than on the Ausable and will be more difficult to handle owing to the large uncontrolled portion of the watershed (approximately 50%) being situated below the trouble area but which contributes to the flooding of the latter and also because of the lack of suitable storage above. From Figure H-4 it will be noted that there are six creeks emptying into the Old Ausable River channel between its confluence with Parkhill Creek and Grand Bend. These streams have an average gradient of 17.5 feet per mile giving rise to a very heavy run-off which soon fills the channel to,

and often beyond, its capacity. With the lower part of the channel full, the flow from the upstream areas is seriously hampered and the water is backed up onto the low-lands in the vicinity of Devil's Elbow. This old channel was improved in 1929 from above the tri-county bridge to Grand Bend, a total distance of 9.5 miles, at a total cost of $91,010.00. During the twenty years since this improvement, the channel has been silted up considerably and in places overgrown with brush. The actual capacity of the channel has thereby been considerably reduced. Thus it would seem logical to provide increased flow in the lower part of the Old Ausable River channel and to build dams and reservoirs above to regulate the flow into this part of the Parkhill Creek system and prevent flooding of the low-land.

1. <u>SUMMER FLOODS OF THE MAGNITUDE OF 1947</u>

Floods of this magnitude have a probable frequency of once in 12 years for the summer months and every year for the spring months at normal lake level. The capacity of the Old Ausable River channel at Grand Bend is estimated to be 1200 c.f.s. The peak flow of the 1947 summer flood was approximately 2470 c.f.s. Therefore to prevent summer floods of this magnitude it will be necessary to (a) increase the present channel capacity from 1200 c.f.s. to 2470 c.f.s. or (b), provide a reservoir upstream to reduce the peak flood flow from 2470 c.f.s. to 1200 c.f.s.

(a) <u>Lesser Old River Bed Improvement</u>

This plan would provide for an improved channel from Grand Bend to a point on Parkhill Creek 1.2 miles above its confluence with the Old Ausable River at Devil's Elbow, an overall distance of 9.65 miles (Fig.H-2). The Channel would be dredged and widened uniformly from a 27 foot bottom width at the upper end to a 70 foot bottom width at Grand Bend. Designed to carry 10 feet of water throughout,

the channel would have a uniform slope of .014 per cent, and at a lake level of 580.0 it would safely discharge flows of the 1947 summer flood magnitude. Assuming that the excavated material may be disposed of along the banks, the estimated cost would be:

Estimated cost	$267,501.00

(b) McInnis Dam (26 feet) and Reservoir

To reduce the peak summer flow of 2,470 c.f.s. to the present channel capacity of the old river bed would require approximately 4,000 acre feet of storage. This amount of storage is available at several points along the upper part of the creek, but the McInnis site being closest to the flood problem would be the most suitable one. The dam for this reservoir would be located about 1.5 miles southwest of McInnis just east of the road between Lots 20/21, Concession VI of McGillivray Township. At full capacity, the reservoir would have 21 feet of water at the dam and would extend back 3.0 miles on the north arm and 1.8 miles on the south arm, with a total surface area of 540 acres. This would be an earth-filled controlled dam with a concrete spillway section capable of discharging 5,190 c.f.s.

Estimated cost	$227,638.00

2. SPRING FLOODS OF THE MAGNITUDE OF 1947

The 1947 spring flood had an estimated peak flow of 4,650 c.f.s. Flows of this magnitude might be expected once in 12 years for the spring months. Such floods could be controlled as follows:

(a) Greater Old River Bed Improvement

To confine flows of this magnitude by this

means it would be necessary to widen and dredge the present channel from Grand Bend to a point on Parkhill Creek 1.2 miles above its confluence with the Old Ausable River at Devil's Elbow, a distance of 9.65 miles. In addition, the section from the head of the channel improvement up to the road between Lots 20 and 21, Concession VI, McGillivray Township, would be cleaned out to give the flood waters a free entry into the new channel section. The channel would have a 43 foot bottom width at the upper end, increasing gradually to a 98 foot bottom at Grand Bend. Graded from an elevation of 568 feet at the lake to elevation 577.5 feet at the head, the channel would have a uniform slope of .014 feet per hundred and when full would have a maximum water depth of 12 feet throughout. At a lake level of 580.0 the channel would discharge 4,670 c.f.s. at approximately 3.5 feet per second.

Estimated Cost $791,632.00

(b) McInnis Dam (31 feet) and Parkhill Dam (29 feet) combined with Lesser Old River Bed Improvement

The Lesser Old River Bed Improvement provides for a channel flow of 2,470 c.f.s. at Grand Bend or about 53 per cent of the flow experienced in the 1947 spring flood. To regulate this balance of flow it would be necessary to reduce the flow at McInnis to 500 c.f.s., which would require approximately an additional 12,000 acre feet of storage. This extra amount of storage would be provided by increasing the twenty-six foot dam at McInnis to thirty-one feet and building an additional dam and reservoir above the village of Parkhill. The McInnis dam would be in the same location as described in Scheme

1 (a) above, but with this higher dam the reservoir would have an area of 1,245 acres as compared to the 540 acres for the lower dam. The Parkhill dam would be located about three quarters of a mile north of the Town of Parkhill, on Lot 5, Concession V, McGillivray Township, just east of No. 81 Highway. When full, the reservoir would have a maximum depth of 24.0 feet at the dam and would extend easterly for a distance of 2.5 miles with a surface area of 195 acres.

Estimated cost

Lesser Old River Bed Improvement ...	$267,501.00
McInnis Reservoir (31.0 dam - 9,000 acre feet)	356,767.00
Parkhill Reservoir (29.0 dam - 3,000 acre feet)	260,000.00
Total Cost	$884,268.00

(c) McInnis Dam (31 feet) and Parkhill Dam (36 ft)

As an alternative to the two schemes outlined above, such floods may be controlled by means of storage reservoirs alone. This would require 15,300 acre feet of storage. This would be provided by a thirty-one foot dam at McInnis (same as 2 (b) above) and by increasing the Parkhill dam from 29 feet to 36 feet. The McInnis reservoir would provide 9,000 acre feet of storage and the Parkhill 6,300 acre feet. The larger Parkhill dam would have a maximum water depth of 31 feet and the reservoir would be 4.5 miles long with a water surface area of 270 acres. The McInnis and Parkhill dam sites would be located as they are outlined for Scheme 2 (b) above.

Estimated cost

McInnis Reservoir (31.0 dam - 9,000 acre feet)...	$356,767.00
Parkhill Reservoir (36.0 dam - 6,300 acre feet)...	402,126.00
Total Cost	$758,893.00

(4) One Hundred Year Floods

In a previous section of this Report, mention was made that in good engineering practice it is customary not only to plan works for floods which have been known to occur in the past, but also for those which might occur within one hundred or a longer period of years. This is done by the use of flood hydrographs (charts) based on known flows of the river concerned and by the records of precipitation over the whole watershed.

However, under certain circumstances, especially when the areas to be protected from such flooding do not warrant the expense, a compromise must be made which will give protection only from known floods. When this is the case, it is considered satisfactory to "take a chance" on such unforeseen floods and if and when they do occur, hope that the damage will not be severe.

For example, on the Muskingum Conservancy District, flood control reservoirs were built to provide protection for known floods in the past, plus a margin of safety for the future. But, in the studies carried out, it was shown that a greater flood might occur once in one hundred years which could not be held back by the dams and reservoirs which have now been built. The engineers realize that if such a flood should occur that hundreds of acres of land, a mile or two of highway and part of a railway right-of-way will be covered with several feet of water for a few days. But the loss thus sustained would be far, far less an item of expense than the building of dams and reservoirs of a size to ensure that such land would never be flooded. A comparable condition to this exists on the Ausable with respect to the low-lying lands near the mouth of the river.

To give protection for unforeseen floods for the Main Ausable System, three possible methods can be used. The first would include the Greater Port Franks Improvement Channel and the 61 foot Arkona Dam and Reservoir. This

TABLE H-1

DAM and RESERVOIR DATA for FLOOD CONTROL

A. Main Ausable System

TABLE NO.	NAME	SCHEME NO.	DAM DATA				RESERVOIR DATA			CAPITAL COST DAM and RESERVOIR	COST PER ACRE-FOOT
			HEIGHT (feet)	LENGTH (feet)	FREEBOARD (feet)	DISCHARGE CAP. (c.f.s.)	LENGTH (miles)	AREA (acres)	CAPACITY (acre-feet)		
1	Arkona	1(b)	45.0	450	5.0	22,395	9.5	420	7,000	$ 382,500	$54.64
2	Arkona	2(b)	60.0	771	6.0	22,395	14.0	1,060	20,000	723,058	36.15
3	Arkona	100 Yr.	61.0	776	6.0	22,395	14.3	1,080	21,500	752,608	35.00
4	Arkona	2(c)	68.5	820	6.0	22,395	16.0	1,850	35,000	1,010,624	28.87
5	Arkona	100 Yr.	71.0	839	6.0	22,395	17.0	2,150	40,000	1,092,500	27.31
6	Arkona	100 Yr.	72.0	850	6.0	22,395	17.2	2,300	42,500	1,132,396	26.64
7	Ailsa Craig	100 Yr.	43.0	1,675	5.0	13,068	6.5	600	10,000	632,758	63.28
8	Thedford	100 Yr.	59.0	1,508	5.5	23,708	6.0	670	20,000	1,574,643	78.73
9	Hay Swamp	*	13.0	13,800	3.0	2,330	1.8	2,700	10,400	200,000	19.25

* Hay Swamp Dam and Reservoir for summer flow only.

TABLE H-2

DAM and RESERVOIR DATA for FLOOD CONTROL

B. Parkhill Creek System

TABLE NO.	NAME	SCHEME NO.	DAM DATA				RESERVOIR DATA			CAPITAL COST DAM and RESERVOIR	COST PER ACRE-FOOT
			HEIGHT (feet)	LENGTH (feet)	FREEBOARD (feet)	DISCHARGE CAP. (c.f.s.)	LENGTH (miles)	AREA (acres)	CAPACITY (acre-feet)		
1	McInnis	1(b)	26.0	1,035	5.0	5,190	N. 3.0* S. 1.8	540	4,000	$227,638	$56.90
2	McInnis	2(b)	31.0	1,365	3.0	5,190	N. 4.0 S. 3.0	1,245	9,000	356,767	39.64
3	Parkhill	2(b)	29.0	990	5.0	2,660	2.5	195	3,000	260,000	86.70
4	Parkhill	2(c)	36.0	1,007	5.0	2,660	4.5	270	6,300	402,126	67.02

* N. and S. are used here to denote the North and South arms of the McInnis Reservoir.

TABLE H-3

DETAILS OF CHANNEL IMPROVEMENT

A. Main Ausable System

NAME	SCHEME NO.	LENGTH (miles)	BOTTOM WIDTH (feet)	GRADE (feet per hundred)	SIDE SLOPES (ratio)	FLOW CAPACITY (c.f.s.)	CAPITAL COST
Lesser Port Franks Improvement Channel	1(a)	1.52	60	Flat	$1\frac{1}{2}$:1	3,000	$276,396
Greater Port Franks Improvement Channel	2(a)	1.52	180	Flat	$1\frac{1}{2}$:1	7,550	763,248

B. Parkhill Creek System

NAME	SCHEME NO.	LENGTH (miles)	BOTTOM WIDTH (feet)	GRADE (feet per hundred)	SIDE SLOPES (ratio)	FLOW CAPACITY (c.f.s.)	CAPITAL COST
Lesser Old River Bed Improvement	1(a)	9.65	27 to 70	.014	$1\frac{1}{2}$:1	2,100	267,501
Greater Old River Bed Improvement	2(a)	9.65	43 to 98	.014	$1\frac{1}{2}$:1	4,650	791,632

Old Arkona Power dam

Ausable River gorge at proposed Arkona Damsite.

Earthen dam with planked spillway near Denfield.

Bell sawmill dam near Hensall.

would cost $1,515,856.00. The second would include the Lesser Port Franks Improvement Channel, the 71 foot Arkona Dam and Reservoir and the 43 foot Ailsa Craig Dam and Reservoir at a cost of $2,001,654.00. The third would be conservation reservoirs alone at Arkona, Ailsa Craig and Thedford at a cost of $3,339,797.00.

To give protection for unforeseen floods for the Parkhill Creek System would require the Greater Old River Improvement, together with the 31 foot McInnis Dam and Reservoir which would cost $1,148,399.00.

This report does not recommend such costly works as they are out of all proportion to the damage which might occur over the years. If and when such flooding takes place, adjustment might be made to the land owners affected if such is considered justifiable.

(5) Recommendations

A study of the flood problems on the Ausable Watershed indicates that the summer floods are the chief concern of those within the trouble areas and thus protection against summer flooding only would appear to be sufficient at the present time. However, from the flow records for the rivers throughout Southern Ontario it will be noted that there has been a gradual increase in the magnitude of floods and when selecting a flood control scheme, future requirements should be kept in mind. This is especially true where hydraulic structures such as dams, diversion channels etc are concerned since any attempt to increase their capacity at a later date usually results in substantially higher costs.

If it is decided that protection against summer floods such as were experienced in 1947 is all that is necessary for the present, then it is recommended that the following works be carried out on the two systems:

MAIN AUSABLE SYSTEM:

The Lesser Port Franks Improvement Channel
(Scheme A.1 (a) - ($109,000.00.)
(With breakwaters $276,396.00)

PARKHILL CREEK SYSTEM:

The Lesser Old River Bed Improvement.
(Scheme B.1 (a) $276,501.00).

If a greater degree of protection is desired such as against spring floods of the 1947 magnitude, it is recommended that the following works be carried out on the two systems:

MAIN AUSABLE SYSTEM:

The Lesser Port Franks Improvement Channel and the Arkona Dam (60 feet) and Reservoir.
(Scheme A.2 (b) $999,454.00).

PARKHILL CREEK SYSTEM:

The McInnis Dam (31 feet) and Parkhill Dam (29 feet) combined with the Lesser Old River Bed Improvement.
(Scheme B.2 (b) $884,268.00).

3. SUMMER FLOW:

(1) General

While the control of flood waters on any river is superficially the most urgent problem to be solved, nevertheless, the desirability of increasing summer flow is also important. More water in a river in the summer is an asset to agriculture, provides a means of flushing out the channel and is necessary for the presence of fish life.

For summer flow the reservoirs are not necessarily as large as those for flood storage, but to obtain a reasonable amount of flow their number would have to be increased. Moreover, the presence of many smaller reservoirs on a watershed adds to the recreational value of the area, provides habitat for fish and where the soil is porous, allows for deep seepage into the underlying water table for use of farm wells.

When considering the needs of water conservation on the Ausable Watershed, consideration was given to the possibility of providing increased summer flow, and for this purpose, a number of small reservoirs were indicated (Table H-4). These are shown on Figure H-4. The construction of

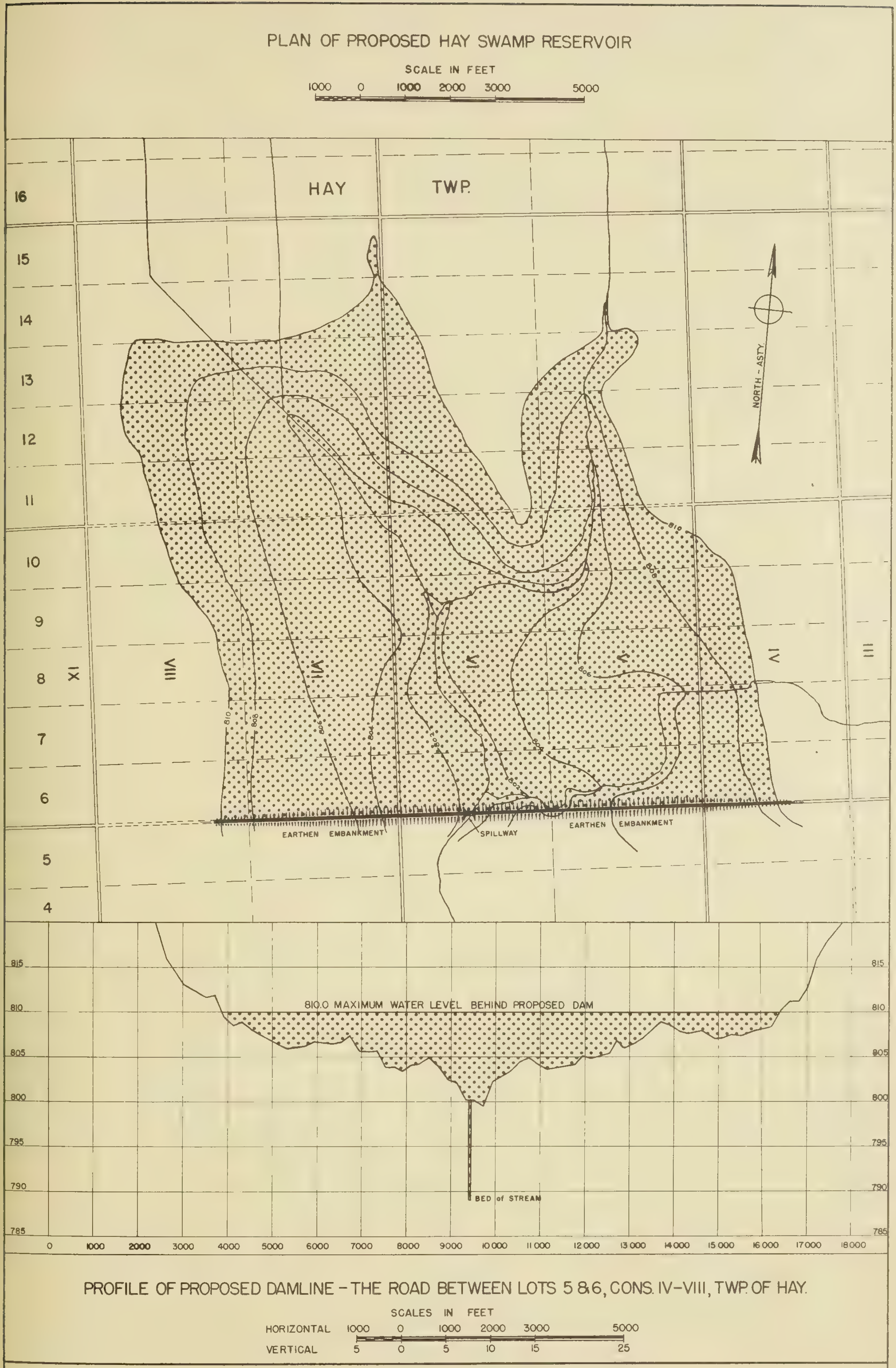
TABLE H-4

DRAINAGE AREAS OF POSSIBLE RESERVOIRS

AND UNCONTROLLED AREAS

RESERVOIR		LOCAL DRAINAGE AREA
NO.	NAME	SQ. MILES
1	Exeter	36.2
2	Whalen	35.1
3	Lucan	20.1
4	Clandeboye	2.8
5	Greystead	8.8
6	Bowood	9.4
7	Nairn	3.2
8	Falkirk	29.7
9	Ailsa Craig	94.7
10	Hay Swamp	41.0
11	Mount Carmel	20.5
12	Lieury	13.2
13	Parkhill	13.1
14	Arkona	79.0
15	Keyser	5.9
16	Crathie	15.1
17	Adelaide	13.0
18	William	2.1
19	Sylvan	2.0
20	Thedford	21.0
21	McInnis	44.5
A	Uncontrolled area below McInnis dam site	90.0
B	Uncontrolled area below Thedford dam site	26.4
X	Drainage area direct to lake through sand dunes	11.4
Z	Drainage area of Jericho and Mud Creeks	27.2
	Total Area of Watershed	665.4

Total Drainage Area Ausable River	484.1
Total Drainage Area Parkhill Creek	181.3
Total Drainage Area in the Main Ausable System Control	419.1 Sq. Mi.
Total Drainage Area in the Parkhill Creek System Control	91.3 " "



PLAN AND PROFILE OF PROPOSED HAY SWAMP RESERVOIR

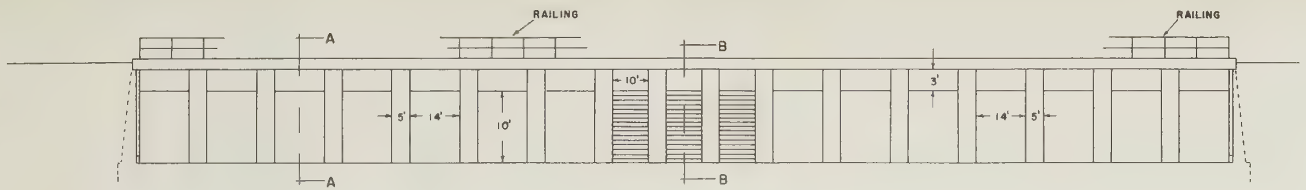
LYING IN LOTS 6-15, CONS. IV-VIII, TWP. OF HAY, HURON COUNTY.

RESERVOIR AREA

SCALES-AS SHOWN

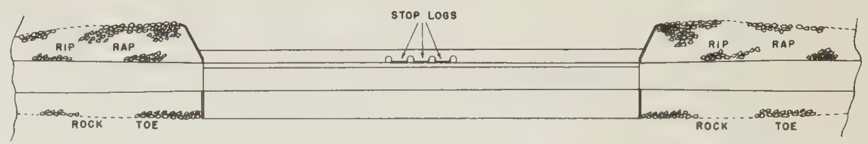
ELEVATIONS ABOVE MEAN SEA LEVEL, G.S.C.

FIG. H-5



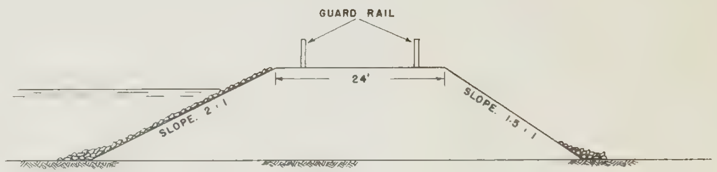
ELEVATION

SCALES: HOR. 1" = 20'
VER. 1" = 10'



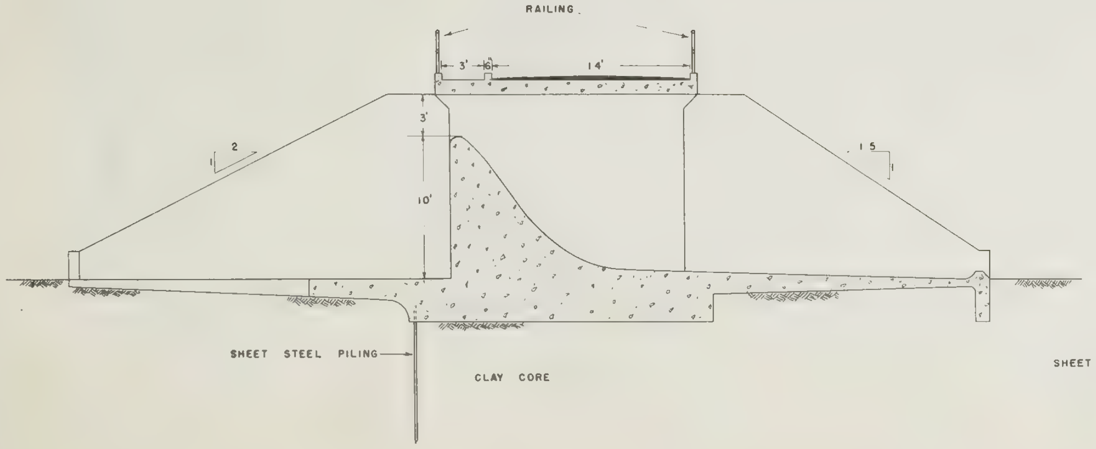
PLAN

SCALE 1" = 50'



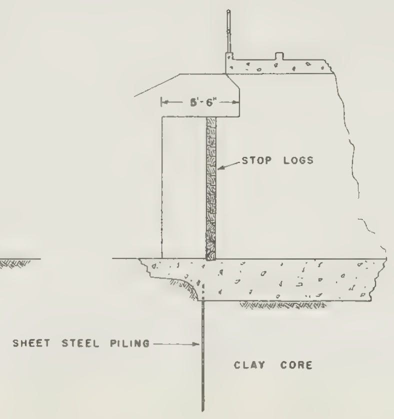
SECTION THROUGH EARTH DAM

SCALE 1" = 10'



SECTION A–A

SCALE 1" = 5'



SECTION B–B

SCALE 1" = 5'

PROPOSED TYPE OF DAM

HAY SWAMP RESERVOIR

SCALES: AS SHOWN

FIG. H-6

all these reservoirs, at the present time, is not feasible because of the cost, but are set down to indicate where such storage may be found if and when, at some future date, a more complete hydraulic solution for water conservation is desired on the watershed.

The most strategic part of a watershed, where summer flow reservoirs are most desirable, is of course at or near the headwaters of a river system. Such storage can be found on the Ausable in Hay Swamp, where a reservoir can be built at low cost, which will provide an appreciable amount of summer flow.

(2) Hay Swamp Reservoir

An earth and concrete controlled dam 13.0 feet high located along the road between Lots 5 and 6, Concessions IV to VIII, Hay Township, would provide 10,400 acre feet of storage. The reservoir (Fig. H-5) would have a water surface area of 2,700 acres when full, with a maximum depth of 10 feet at the dam. Most of the area is swamp and willow-scrub bush with some poor pasture, and attempts to improve this land by means of drains have failed.

Assuming that the summer rains will replace the water lost through evaporation and deep-seepage, this reservoir would supply a continuous flow of 41 c.f.s. throughout the period May 15 to Sept. 15. (123 days).

The proposed type of dam for this reservoir is shown in Figure H-6 and the estimated cost of the dam and reservoir, including a 14 foot roadbed along the top of the dam is $200,000 or approximately $19.25 per acre foot of storage.

4. HYDROLOGICAL DATA:

(1) Run-off for Spring Freshets

Run-off is that portion of precipitation in the form of rain, melted ice or snow which reaches the tributaries and rivers directly by surface flow. The rate of run-off

is expressed in cubic feet per second per square mile (c.f.s./sq. mi.) and can be measured by gauges set up in the river. The rate of run-off varies not only with the duration and intensity of precipitation but also with many physical features of the area such as geographical location, geological and ground surface conditions, swamps and lakes, existing reservoirs, gradient and distribution of the river and tributary channels, ground surface slopes, forest cover and climatic conditions, all of which may vary greatly not only with the different watersheds but over areas within a watershed itself. A knowledge of run-off is necessary in most engineering problems related to water but with flood control measures involving reservoirs and dams, a reliable knowledge of a maximum rate of run-off is vital.

Run-off is determined by installing gauges at strategic points along the rivers and after hydrometric surveys have been made, the discharge at that section can be readily determined for any gauge reading. Gauge readings may be recorded automatically or by an observer. In the latter case readings are usually taken twice daily or more frequently during times of flooding if necessary. If these records extend over a sufficient number of years a frequency curve based on the theory of probability may be derived. This curve indicates the frequency with which a given flood should be expected. The term "probable" is used advisedly as the curve is based on the law of averages for known floods and there is no assurance that the respective values may not be exceeded. The method is widely used, with safety factors in engineering practice today. Freak floods of unexpected magnitude are provided for by means of spillways.

Flow records, covering a number of years, are available for the rivers of Southern Ontario which have hydro power potential but it was not until the advent of conservation and flood control that it was considered necessary to obtain flow records for those rivers which have a history of

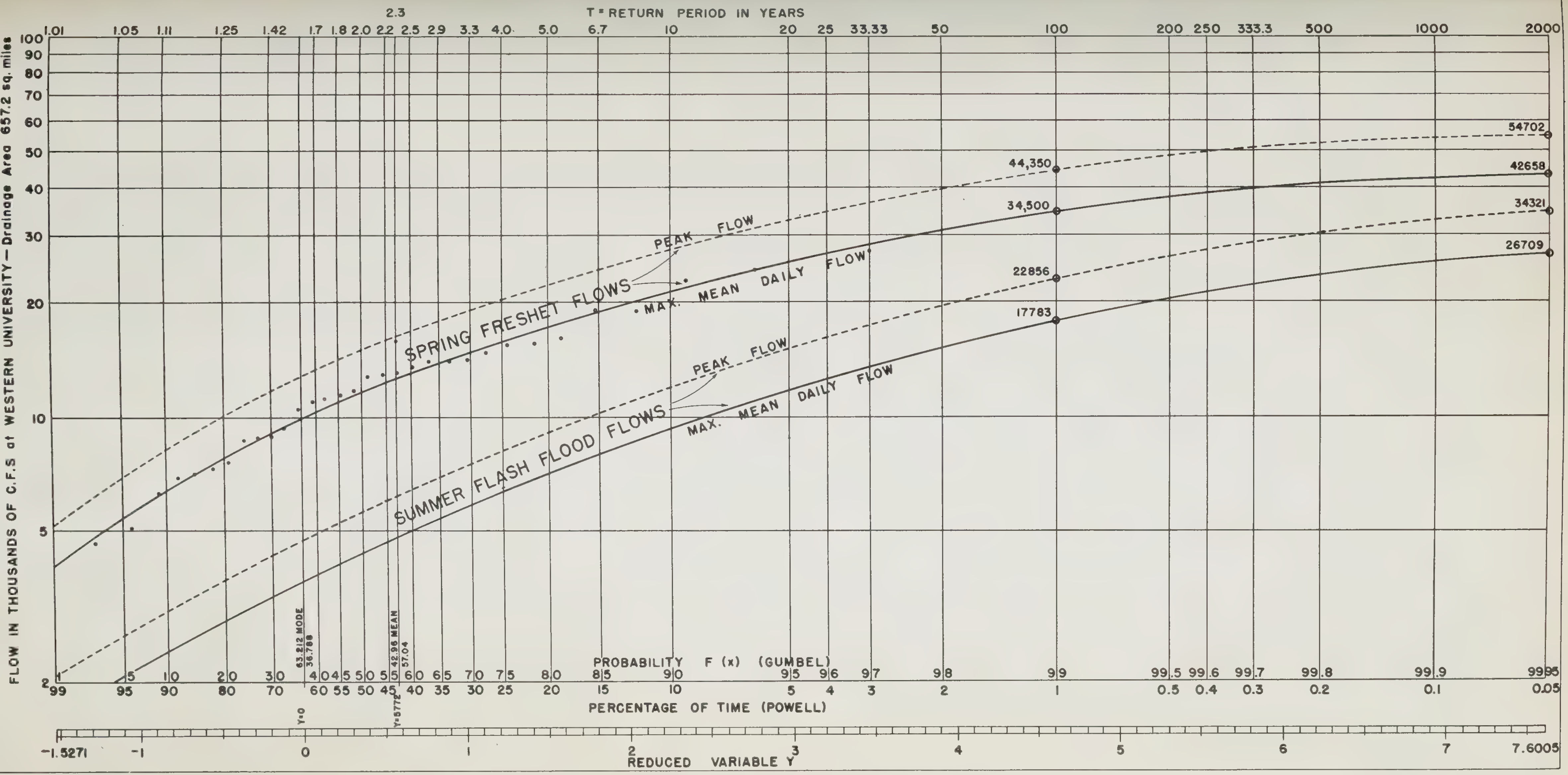
spring floods. Often these rivers have summer floods as well. In general the spring and summer floods are followed by long periods of extremely low flows. The Ausable River is one of these rivers and there are only five years of flow records taken during two periods. The first period was from August 1915 to September 1917 for the Arkona gauge located on the river near the Village of Arkona and the second period from October 1945 to the present for the new Springbank gauge located 12 miles farther upstream. These records, although they are far short of the number of years necessary to compute a frequency curve, are of inestimable value for comparison with the North Branch of the Thames[1] Watershed which is east of and adjacent to the Ausable Watershed, and for which there are flow records for 33 years dating from 1916. The frequency curve for the North Branch of the Thames is shown in Fig. H-7. There are records of seven floods for the Ausable and Table H-5 shows the run-off ratios for the Ausable and the North Branch Watersheds for these floods which occurred on both watersheds during the same period.

The averages of these ratios, 0.77 for the maximum mean daily flows and 0.82 for the average flow for the duration of the flood period, were then determined and applied to the North Branch flow records to convert them to the relative Ausable flows and thus supplement the incomplete flow records for the latter. The seven recorded flood flows for the North Branch cover a wide variety of conditions and it is believed that the resultant factors obtained are reliable. A comparison of the physical features of the North Branch and the Ausable suggests that the run-off on the latter will be somewhat less than on the former.

(2) Run-off for Summer Storms

Generally, summer floods are of less magnitude than those occurring at the spring freshet, although the summer storms are more intense, have a more extensive distribution

1. Hereafter referred to as "North Branch" for brevity.



NOTE:
Fanshawe Discharges 1916-1943 Converted to Western University

FREQUENCY CHART

FOR FLOODS ON THE NORTH BRANCH OF THE THAMES WATERSHED

FIG. H-7

AUSABLE VS. NORTH BRANCH THAMES - RUN-OFF RATIOS

TABLE H-5

YEAR	FLOOD DISCHARGES PEAKS AND MEANS FOR FLOOD PERIOD				RATE OF RUN-OFF C.F.S. PER SQ. MILE		RATIO- AUSABLE AND NORTH BRANCH THAMES	
	DATE	FANSHAWE GAUGE C.F.S. AREA 562.9	DATE	ARKONA GAUGE C.F.S. AREA 393.8	DRAINAGE AREA SQ. MILES FANSHAWE 562.9	ARKONA 393.8	MAXIMUM MEAN DAILY RUN-OFF	MEAN RUN-OFF OVER FLOOD PERIOD
1916	Jan. 3 Jan. 1 - 10	10,840 6.609	Jan. 6 Jan. 1 - 10	7,000 2,585	*19.26 11.74	*17.78 6.56	0.9232	0.5588
1916	Mar. 28 Mar. 27 - Apr. 5	6,270 4,070	Mar. 29 Mar. 27 - Apr. 5	7,940 3,745	11.14 7.23	20.16 9.51	1.8097	1.3153
1917	Mar. 24 Mar. 21 - 30	11,840 4,462	Mar. 24 Mar. 21 - 30	3,710 1,819	21.03 7.93	9.42 4.62	0.4479	0.5826
		WESTERN UNIV. GAUGE C.F.S. AREA 657.2		SPRINGBANK GAUGE C.F.S. AREA 334.0	WESTERN UNIV. 657.2	SPRINGBANK 334.0		
1946	Mar. 7 Mar. 2 - 12	18,880 5,746	Mar. 8 Mar. 2 - 12	4,270 2,586	28.73 8.74	12.79 7.75	0.4452	0.8867
1947	Apr. 6 Apr. 1 - 10	26,980 9,854	Apr. 6 Mar. 31 - Apr. 9	7,320 3,336	41.05 14.99	21.93 9.99	0.5342	0.6664
1947	Mar. 25 Mar. 22 - 31	13,480 4,034	Mar. 25 Mar. 22 - 31	5,270 2,227	20.51 6.14	15.79 6.67	0.7699	1.0863
1948	Mar. 20 Mar. 15 - 24	22,700 9,544	Mar. 20 Mar. 15 - 24	5,470 3,293	34.54 14.52	16.39 9.87	0.4745	0.6798
					Average of Ratios		0.77	0.82

*Upper ratios in these columns are for maximum mean daily flows and the lower ratios are for the mean run-off for the flood period.

and longer duration than those at the spring break-up. At the break-up period there is usually an accumulation of snow and ice, the ground is more impervious due to the frost and the ground being already saturated, evaporation and transpiration are at a minimum. Therefore, while the rainfall may be greater during the summer storm, the run-off is not as great as it is during the spring freshet.

The frequency curve for the North Branch[1] also shows maximum summer flows and was prepared in the same manner as the curve for spring floods.

As a means of comparison, a ratio of the run-off between the two watersheds for summer storms was derived independently by using the meteorological rainfall records in conjunction with the flow records for four 1947 summer storms which were common to both watersheds. Rainfall records were tabulated for the meteorological station of Lucan, which is located on the Ausable Watershed, and the surrounding nearby stations of Forest, Goderich, Stratford, Woodstock and London. The amount of rainfall recorded for each storm was proportioned between Lucan and each of the other stations, isohyetols for each 1/10 of an inch interval were drawn, the areas measured between them and then the average amount of rainfall in inches determined for both watersheds. Hydrographs for the two watersheds were then plotted from the gauge records for each flood and the volume of run-off above the normal or base flow was determined graphically. With this data, curves were then developed

---

1. The frequency curve for the North Branch was prepared from the flow records for the Fanshawe and the Western University gauges. The Western University gauge is located near the University about 2 miles north of the confluence of the North and South Branches of the Thames and the Fanshawe gauge was located about 3½ miles farther upstream. Fanshawe records date from 1916 to 1943 when it was replaced by the Western University gauge. The Fanshawe flow records (drainage area 562.9 square miles) were converted to Western University flows (drainage area 657.2 square miles) by direct proportioning of their drainage areas.

using the run-off in c.f.s. per square mile as the vertical ordinate and rain-fall in inches as the horizontal ordinate. The results of this method showing maximum mean flows and the volumes of total run-off in excess of the normal run-off or base are tabulated in tables H-6 and H-7 respectively. The averages of the ratios for the four storms are 0.60 for the maximum mean daily run-off and 0.84 for the total run-off above normal for the storm periods. These ratios are only approximate, as, although the rainfall was actually recorded at each of the meteorological stations mentioned, the distribution would not likely be in simple proportion between the stations and also as the records are for 24 hour periods and do not indicate the intensity or duration. It has therefore been considered to be safer to use the higher values, (viz. 0.77 for the maximum mean daily run-off and 0.84 for the total run-off)[1] in the calculations which follow:

(3) Maximum Peaks and Daily Mean Discharge for a Flood Frequency of once in one hundred years

The maximum peak flow and maximum daily mean discharge for the 100 year flood may be derived by two independent methods. Method (A) employs the ratio 0.77 to determine the maximum mean daily discharge from which the peak flow and total run-off for the 100 year flood could then be calculated. Method (B) is the reverse. By this method, the total run-off for a known period for the Ausable is determined by applying the factor 0.84 to the total run-off for the North Branch for a similar period and subsequently determining the maximum mean daily flow and peak flow.

Results of these methods are as follows:

---

1. Since these summer flow studies were made, it has been brought to our attention that, in addition to the six meteorological stations used there was another station, viz. "Centralia" operated by the R.C.A.F. which also recorded the rainfall for one of the 1947 summer storms. Centralia is centrally located on the upper part of the Ausable Watershed and the records for this storm agree within 10 per cent with the interpolated values between Lucan and Goderich. The effect of this difference over the watershed would be less than 3 per cent of the total rainfall for the watershed.

OF MAXIMUM MEAN DAILY RUN-OFF

TABLE H-6

RAINFALL PERIOD 1947	AUSABLE RIVER ABOVE SPRINGBANK GAUGE AREA 334 SQ. MILES			NORTH BRANCH OF THE THAMES ABOVE UNIV. OF WESTERN ONTARIO GAUGE - AREA 657.2 SQ. MI.			RATIO
	AVG. RAINFALL OVER AREA INCHES	PEAK FLOW AT GAUGE C.F.S. ABOVE NORMAL FLOW	UNIT PEAK FLOW C.F.S./SQ. MILE PER INCH OF RAIN	AVG. RAINFALL OVER AREA INCHES	PEAK FLOW AT GAUGE C.F.S. ABOVE NORMAL FLOW	UNIT PEAK FLOW C.F.S./SQ. MILE PER INCH OF RAIN	AUSABLE N. BRANCH THAMES
May 17-21	1.5042	580	1.154	1.3742	2,000	2.111	0.52
May 23-27	0.9731	750	2.331	1.1811	2,720	3.500	0.66
June 1-2	2.3042	3,140	4.080	2.6573	11,880	6.7923	0.60
June 5-8	1.5338	3,500	6.832	1.4838	11,300	11.574	0.59

Average of Ratios 0.60

RATIOS FOR SUMMER STORMS
BETWEEN THE AUSABLE AND THE NORTH BRANCH OF THE THAMES WATERSHEDS
OF THE TOTAL RUN-OFF ABOVE THE BASE OR NORMAL FLOW

TABLE H-7

RAINFALL PERIOD 1947	AUSABLE RIVER ABOVE SPRINGBANK GAUGE AREA 334 SQ. MILES				NORTH BRANCH OF THE THAMES RIVER UNIV. OF WESTERN ONTARIO GAUGE - AREA 657.2 SQ. MI.				RATIO
	AVG. RAINFALL OVER AREA INCHES	TOTAL RAIN ACRE-FEET	RUN-OFF ABOVE NORMAL ACRE-FEET	RUN-OFF PERCENTAGE OF TOTAL RAIN	AVG. RAINFALL INCHES	TOTAL RAIN ACRE-FEET	RUN-OFF ABOVE NORMAL ACRE-FEET	RUN-OFF PERCENTAGE OF TOTAL RAIN	AUSABLE N. BRANCH THAMES
May 17-21	1.5042	26,897.5	3,173.5	11.8	1.3742	48,244.5	7,775.2	16.1	0.732
May 23-27	0.9731	17,329.5	4,819.8	28.4	1.1811	41,465.2	13,725.6	33.1	0.858
June 1-2	2.3042	41,035.9	19,061.2	46.45	2.6573	93,288.1	48,991.7	52.5	0.884
June 5-8	1.5338	27,314.7	16,105.8	58.96	1.4838	52,091.3	34,353.7	65.95	0.894

Average of Ratios 0.84

Method (A)

The frequency curve for the North Branch shows maximum discharges at the Western University gauge (drainage area 657.2 square miles) for the 100 year floods as follows:-

For Spring Freshets

Maximum peak discharge ... ... 44,350 c.f.s.
Maximum mean daily discharge ... ... 34,500 c.f.s.
Rate of peak run-off... $\frac{44,350}{657.2}$ = 67.48 c.f.s./sq.mi.

Rate of maximum mean daily run-off. $\frac{34,500}{657.2}$ = 52.50 c.f.s./sq.mi.

For Summer Storms

Maximum peak discharge ... ... 22,856 c.f.s.
Maximum mean daily discharge ... ... 17,783 c.f.s.
Rate of peak run-off ... $\frac{22,856}{657.2}$ = 34.78 c.f.s./sq.mi

Rate of maximum mean daily run-off: $\frac{17,783}{657.2}$ = 27.06 c.f.s./sq.mi

The ratio factor 0.77, already determined, when applied to these rates of run-off for the North Branch will give the following run-off values for the Ausable (for 100 year flood).

For Spring Freshets

Rate of peak run-off ... 67.48 x 0.77 = 51.96 c.f.s./sq.mi.

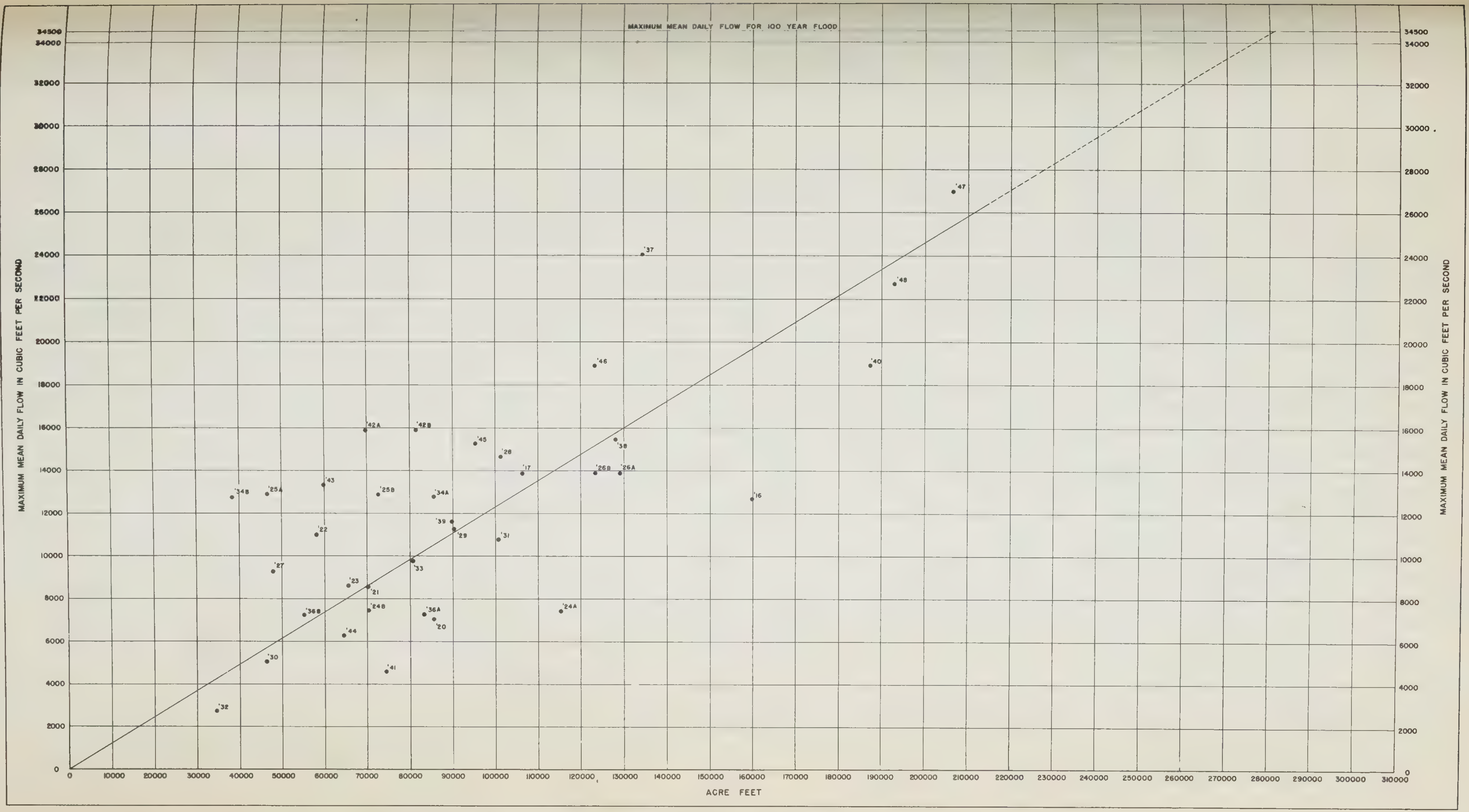
Rate of maximum mean daily run-off. ... 52.50 x 0.77 = 40.42 c.f.s./sq.mi.

For Summer Storms

Rate of peak run-off ... 34.78 x 0.77 = 26.78 c.f.s./sq.mi

Rate of maximum mean daily run-off. ... 27.06 x 0.77 = 20.84 c.f.s./sq.mi

These run-off values for the Ausable are relative to the Springbank gauge. The rate of run-off of the watershed will vary somewhat from place to place but until more records are available from gauges that may be set up later, the rate of run-off will be assumed to be uniform. The table following gives the discharges at Springbank gauge and at the mouths of the Ausable River and Parkhill Creek.



NORTH BRANCH of THAMES

GRAPH SHOWING RELATION BETWEEN MAXIMUM MEAN DAILY FLOWS AND AN ELEVEN DAY RUNOFF FOR SPRING FLOODS FROM 1916 TO 1948

WESTERN UNIVERSITY GAUGE

FIG. H-8

Table H - 8

Discharges for 100 Year Flood.

Drainage Area	Drainage Area in Sq.miles	Unit run-off c.f.s. per sq.mile			
		Spring Floods		Summer Floods	
		51.96 Peak c.f.s.	40.42 Max.Mean Daily c.f.s.	26.78 Peak c.f.s.	20.84 Max.Mean Daily c.f.s.
Springbank Gauge on Ausable River.	334.0	17,355	13,500	8,945	6,960
Ausable River at Port Franks	445.5	23,148	18,007	11,930	9,284
Parkhill Creek at Grand Bend	181.3	9,420	7,328	4,855	3,778

Method (B).

Method (B) used to determine the storage was to apply the Ausable ratio for total run-off (0.84) to the total run-off for the North Branch of the Thames for an eleven day period. (The eleven day duration period was selected in order to include all the above normal flows of each flood). The hydrographs for each of 33 floods on record for the North Branch were plotted and the run-off for an eleven day period for each was determined. Each flood was then plotted on a graph, (Fig. H-8) using the maximum mean daily discharges and the total run-off for the period as the vertical and horizontal ordinates respectively. The best straight line was then drawn through the points and produced to meet the maximum mean daily discharge for the 100 year flood. From this graph the total run-off for the North Branch for this period is 281,300 acre feet. Applying the Ausable ratio, the eleven day run-off for the whole Ausable watershed for the 100 year flood is 281,300 x 0.84 = 236,292 acre feet. Then the corresponding run-offs for the Ausable River and Parkhill Creek are 158,202 and 64,382 acre feet. These are total run-offs for an eleven day period. Then using the eleven days as the base of a

graph and knowing the total run-off, it was possible to calculate the maximum mean daily flows for the 100 year flood for both the Ausable River and Parkhill Creek. The maximum mean daily flows for the 1947 and the 100 year floods are shown in Table H-9. The ratio between the known 1947 flow and the calculated 100 year flow was then determined and used to convert the 1947 flows to the 100 year flood flows in order to be able to plot hydrographs for the latter. This ratio was found to be 1.485.

Table H - 9.

Peak Flows

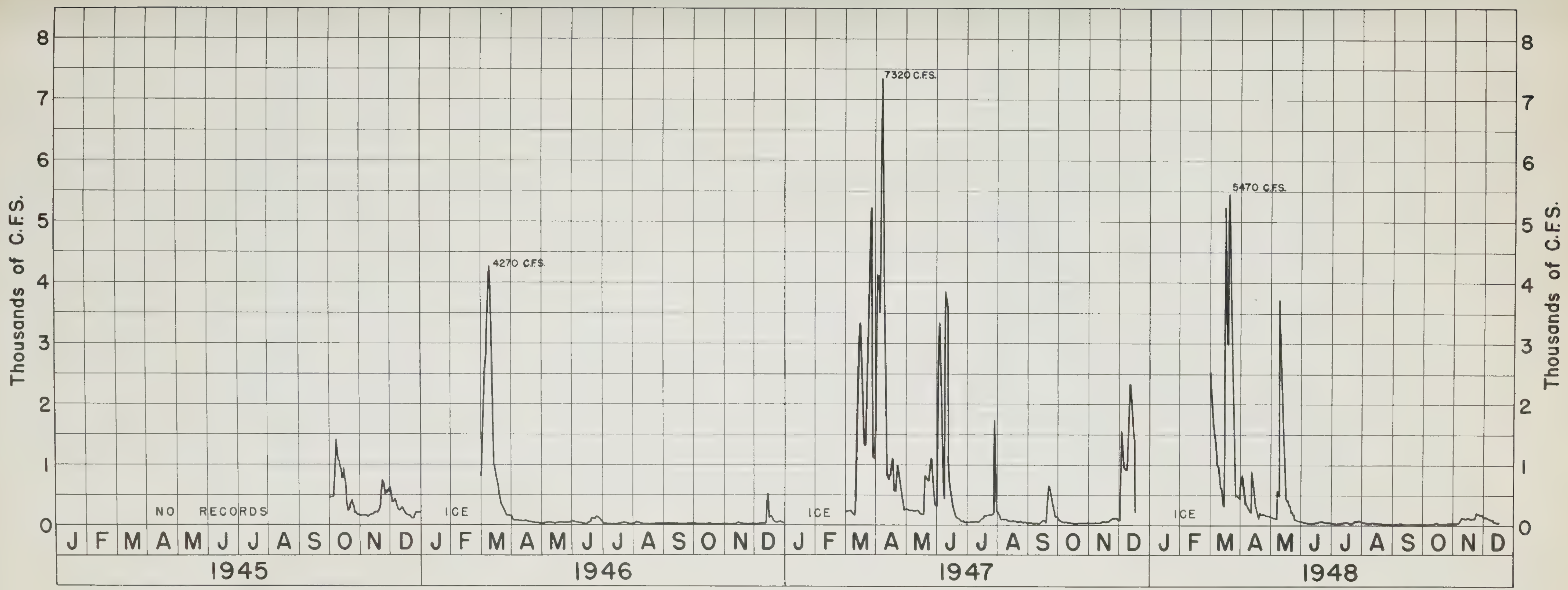
Drainage Area	1947 Spring Flood	100 Year Spring Flood	Ratio
Ausable River	9,763 c.f.s.	14,500 c.f.s.	1.485
Parkhill Creek	3,973 c.f.s.	5,902 c.f.s.	1.485

The latter of these two methods is believed to be the more accurate and the figures given in Table H-9 will be used in the flood control calculations.

(4) Channel Capacity.

Channel capacity is the maximum flow in a river or channel which is contained within the banks and does not overflow the adjacent low lands. In this report it is applied to the rivers and channels passing through the Thedford Flats and Klondyke Area to Lake Huron. This rate of flow for the Ausable River at Port Franks has been determined to be approximately 3250 c.f.s. with a lake level of 580.0. The channel capacity with the improved channel section and grade as proposed by Colonel Archibald would be 6250 c.f.s. at this same lake level.

There is no gauge on Parkhill Creek and the only way to arrive at a channel capacity for Parkhill Creek is by proportioning of areas. The channel capacity at Grand Bend is roughly estimated to be 1200 c.f.s. Channel



Drainage Area 334·0 Sq. Miles

HYDROGRAPHS

GAUGE ON MAIN BRANCH AT SPRINGBANK
DAILY MEAN FLOWS PLOTTED FROM DOMINION
WATER AND POWER BUREAU RECORDS

FIG. H–9

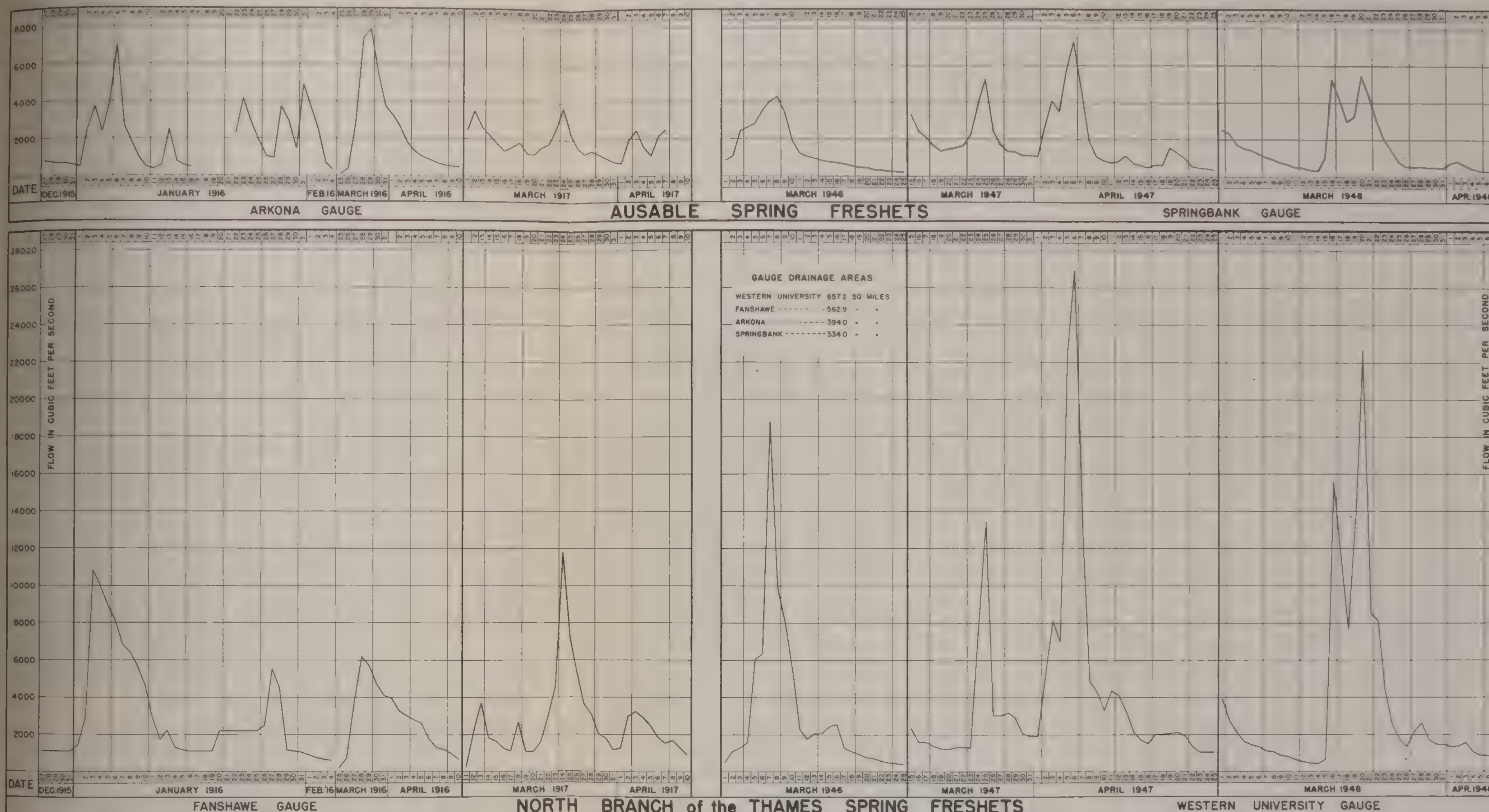
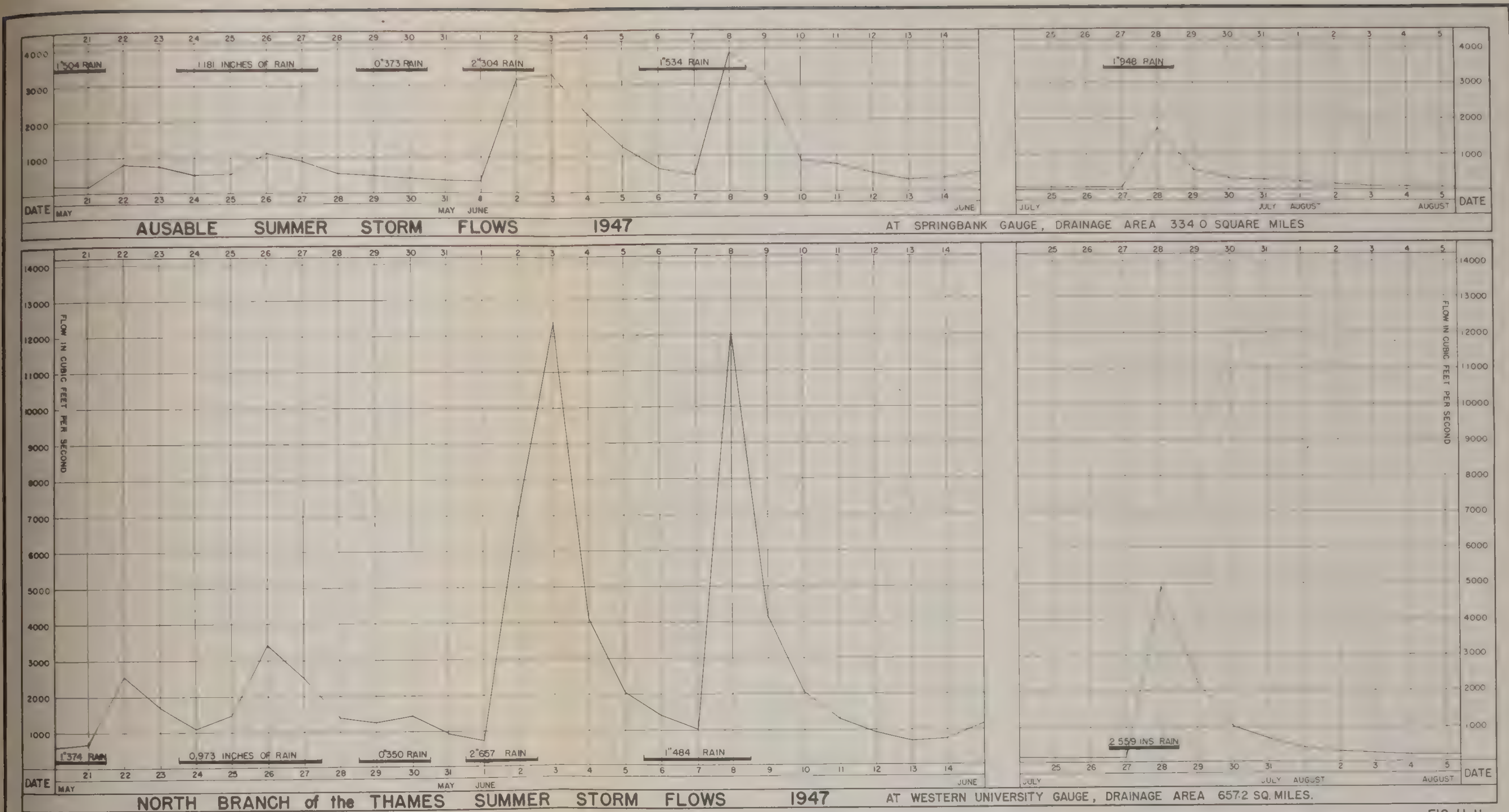
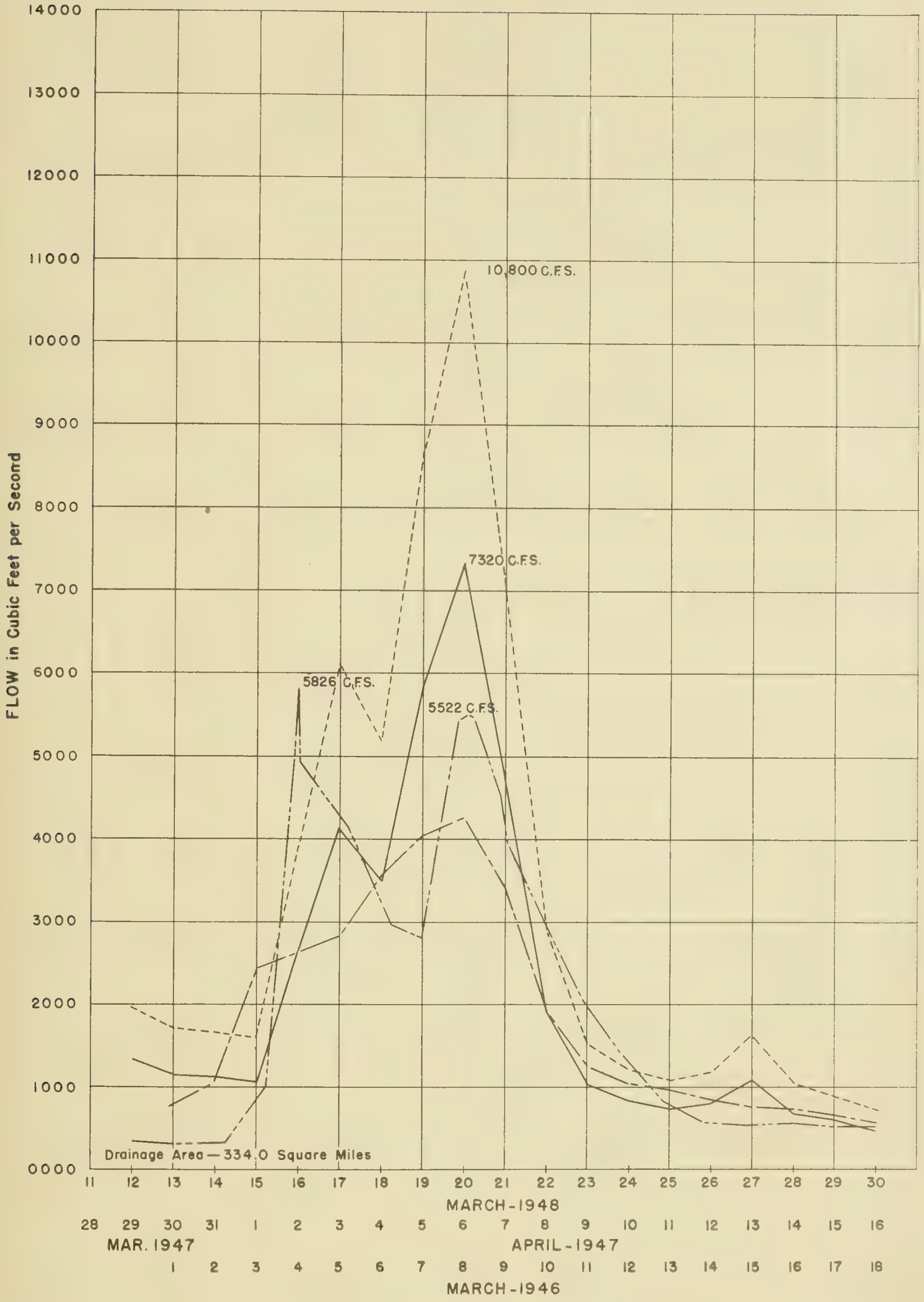

AUSABLE SPRING FRESHETS
ARKONA GAUGE
SPRINGBANK GAUGE
DEC.1915
JANUARY 1916
FEB.16
MARCH 1916
APRIL 1916
MARCH 1917
APRIL 1917
MARCH 1946
MARCH 1947
APRIL 1947
MARCH 1948
APR.1948
DATE
FLOW IN CUBIC FEET PER SECOND
GAUGE DRAINAGE AREAS
WESTERN UNIVERSITY 6572 SQ MILES
FANSHAWE 5629
ARKONA 3940
SPRINGBANK 3340
NORTH BRANCH of the THAMES SPRING FRESHETS
FANSHAWE GAUGE
WESTERN UNIVERSITY GAUGE

FIG. H-10



1"504 RAIN
1.181 INCHES OF RAIN
0"373 RAIN
2"304 RAIN
1"534 RAIN
1"948 RAIN
DATE
MAY
MAY JUNE
JUNE
JULY
JULY AUGUST
AUGUST
AUSABLE SUMMER STORM FLOWS 1947
AT SPRINGBANK GAUGE, DRAINAGE AREA 334.0 SQUARE MILES
FLOW IN CUBIC FEET PER SECOND
1"374 RAIN
0,973 INCHES OF RAIN
0"350 RAIN
2"657 RAIN
1"484 RAIN
2.559 INS RAIN
NORTH BRANCH of the THAMES SUMMER STORM FLOWS 1947
AT WESTERN UNIVERSITY GAUGE, DRAINAGE AREA 657.2 SQ. MILES.

FIG. H-11



FLOOD HYDROGRAPHS

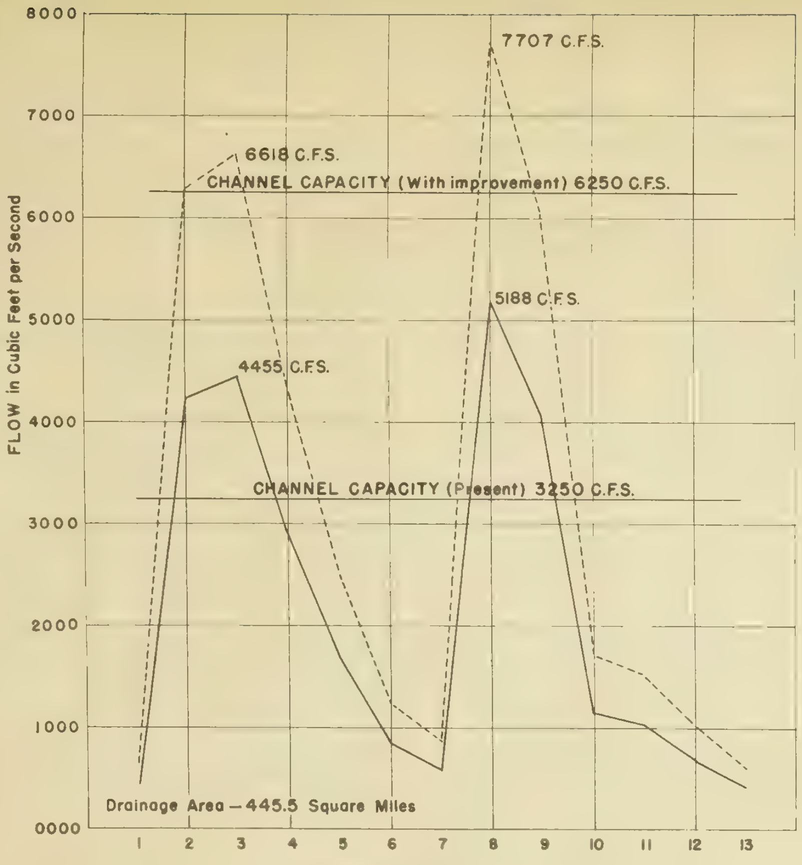
SPRINGBANK

All data derived from Dominion Water & Power Bureau flow records at SPRINGBANK

LEGEND

FLOOD PERIOD 1946
FLOOD PERIOD 1947
FLOOD PERIOD 1948
FLOOD PERIOD 100 YEARS

FIG. H-12



FLOOD HYDROGRAPH

AUSABLE RIVER AT PORT FRANKS

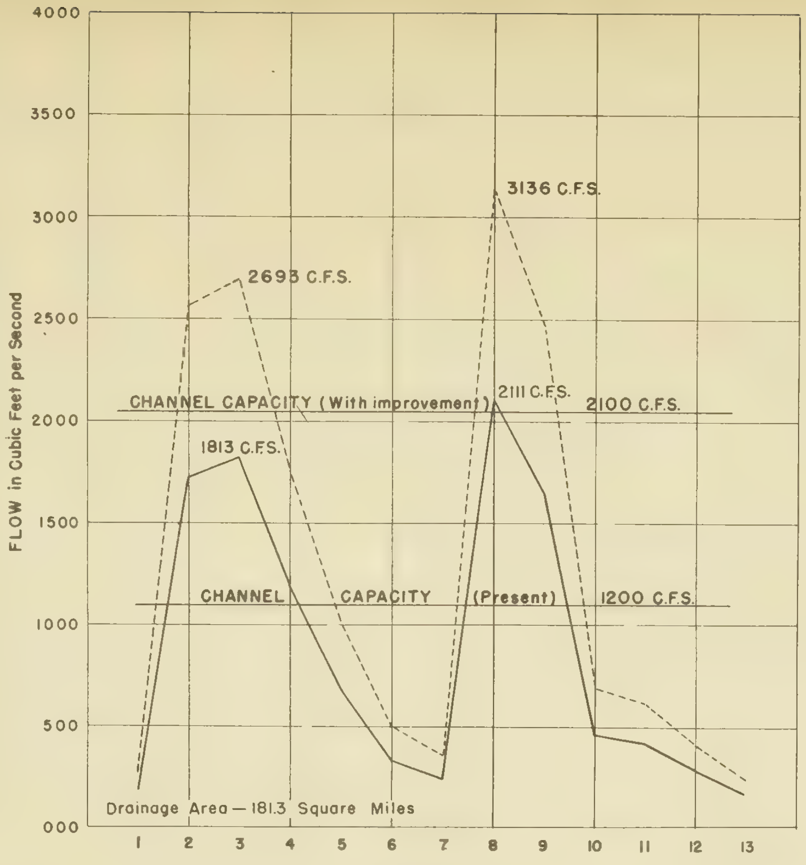
All data derived by proportioning Dominion Water and Power Bureau flow records at SPRINGBANK Channel capacities based on lake level of 580.0

LEGEND

FLOOD PERIOD 1947 ————

FLOOD PERIOD 100 YEARS ------

FIG. H-13



FLOOD HYDROGRAPH

PARKHILL CREEK AT GRAND BEND

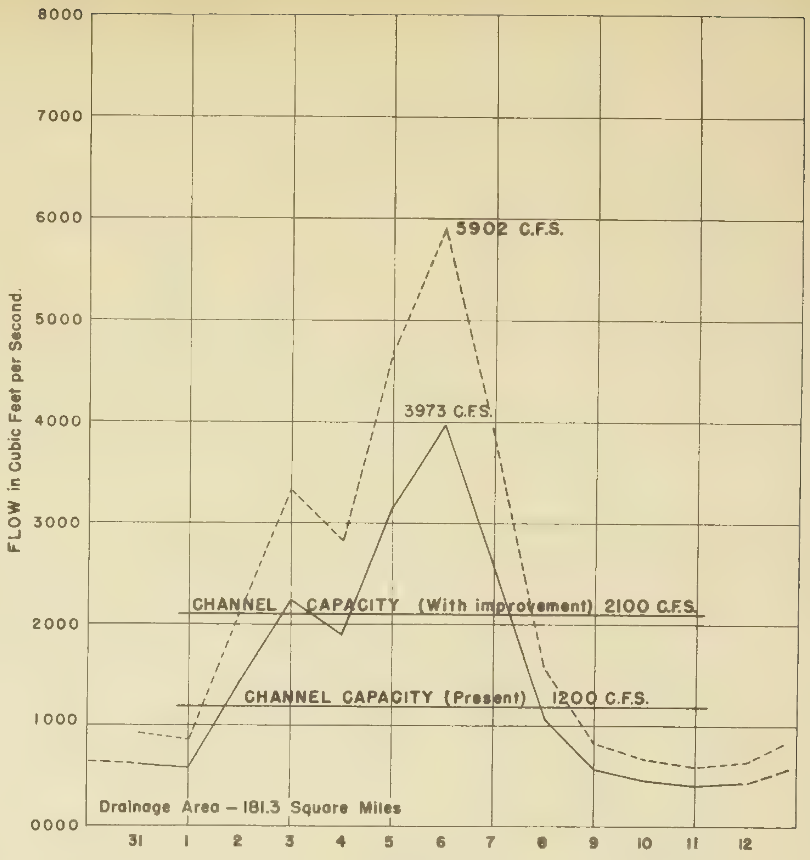
All data derived by proportioning Dominion Water and Power Bureau flow records at SPRINGBANK Channel capacities based on lake level of 580'.0

LEGEND

FLOOD PERIOD 1947 ————

FLOOD PERIOD 100 YEARS ------

FIG. H-14



FLOOD HYDROGRAPH

PARKHILL CREEK at GRAND BEND

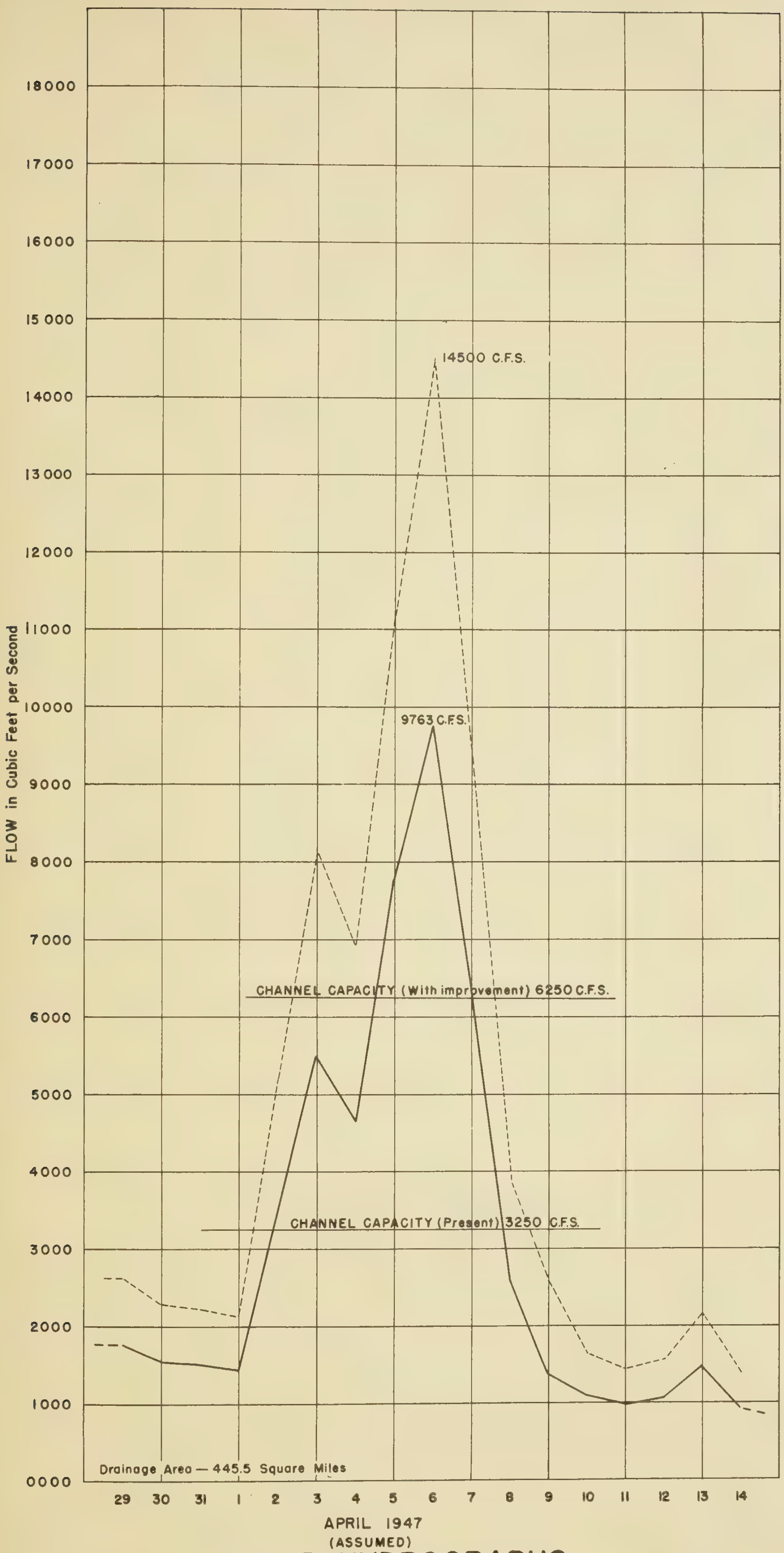
All data derived by proportioning Dominion Water and Power Bureau flow records at Springbank. Channel capacities based on lake level of 580'.0

LEGEND

FLOOD PERIOD 1947 ————

FLOOD PERIOD 100 YEARS ------

FIG. H-16



(ASSUMED)

FLOOD HYDROGRAPHS

AUSABLE RIVER AT PORT FRANKS

All data derived by proportioning Dominion Water and Power Bureau flow records at SPRINGBANK Channel capacities based on lake level of 580.0

LEGEND

FLOOD PERIOD 1947 ————————

FLOOD PERIOD 100 YEARS - - - - - - - - - - -

FIG. H-15

improvements have been carried out on this creek from time to time but it has since become silted up and overgrown to such an extent that the flow is seriously hampered. It is estimated that the channel capacity through the Klondyke Area may be 600 c.f.s. or lower.

(5) Hydrographs.

"The Hydrograph" is a correct expression of the detailed run-off of a stream, resulting from all the varying physical conditions which have occurred on the drainage area above the gauging station previous to the time which it represents.[1] The area of the hydrograph gives the volume of flood waters discharged at the gauge section. A hydrograph prepared from gauge records is fairly reliable for the section where the gauge is located. However, when it is necessary to prepare hydrographs from these flow records for other run-off areas, the results are subject to error and must be regarded as being tentative. The Ausable Watershed has only the one gauge and, as already stated, the run-off computations for the whole watershed have been based on the records for this gauge. Further, the run-off has been assumed to be uniform over the whole watershed, which may or may not be true.

Figure H-9 shows the mean daily flows for the available records of the Springbank gauge for 1946, 1947, 1948 and part of 1945. Figure H-10 shows, for comparison, the mean daily flows for the Ausable and North Branch for spring freshets. Figure H-11 shows for comparison, the mean daily flows for the Ausable and North Branch for summer and fall storms. Figure H-12 shows, superimposed, the spring flood hydrographs for 1946, 1947, 1948 and 100 year for Springbank gauge. From hydrographs Figs. H-13 and H-14, summer floods 1947 and Figs. H-15 and H-16, spring floods 1947, the volume of water that could be let down safely through the present channels, the duration of the flood periods and the total storage required, may be determined.

---

1. Hydrology by Professor D.W. Mead.

CHAPTER 4

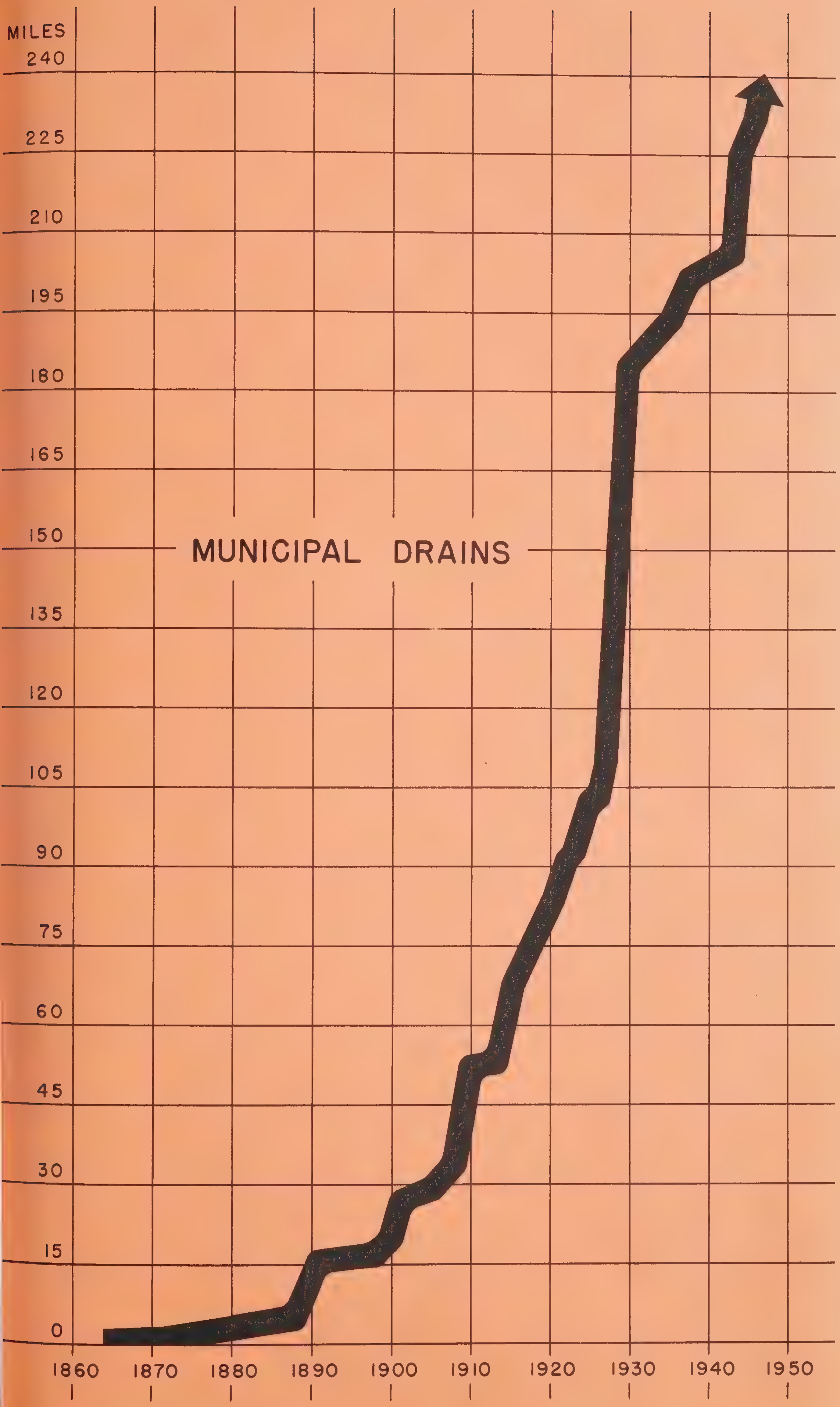
DRAINAGE

Generally speaking, it has always been assumed that the results of drainage are beneficial and that all properties affected by any drainage scheme are benefitted in a greater or smaller degree. Throughout the period of settlement in Southern Ontario this was true to a certain extent as drainage enabled more land to be brought under cultivation, which meant more crops and greater prosperity to the community; also, in many instances, it enabled farmers to work the land earlier in the spring than they would have been able to do otherwise. All drainage legislation to date has been based on this assumption and has resulted in many drainage schemes being extended, not only beyond the bounds of economic feasibility, but even beyond the limits of physical practicability.

The result is that, in many cases, drains have been pushed into areas where they not only do not serve the purpose for which they were intended but actually are a detriment to the welfare of the community by draining water out of natural water storage areas such as swamps and bogs without creating soil conditions dry enough for cultivation or even the maintenance of worth while pasture.

This draining of swamps and bogs means that the water is not available to maintain adequate summer flow in the streams and has also lowered the water table to such a point that wells have gone dry as a direct result of draining. For example, farmers, whose properties border on the Ellice Swamp at the headwaters of large tributaries of the Grand and Thames Rivers, were hauling water for cattle in the summer of 1948 for the first time in living memory.

On the South Nation River attempts have been made to drain areas where the rock surrounding them makes drainage impossible or at best, prohibitively expensive; and


MILES
240
225
210
195
180
165
150
135
120
105
90
75
60
45
30
15
0
MUNICIPAL DRAINS
1860
1870
1880
1890
1900
1910
1920
1930
1940
1950

on the Ausable, itself, it is doubtful if there is sufficient fall between the level of Smith Lake and the high water level of Lake Huron to drain the lands surrounding the former.

Some drainage schemes are necessary and beneficial, others are ill-considered and unwise, therefore, no drainage scheme should be undertaken without due consideration of all the physiographic and economic features, indeed the Kennedy Report[1] makes the following recommendations:

(a) that no drainage project be undertaken until its probable effect upon the community as a whole has been considered by a board of referees, composed of judicial and engineering personnel, as well as practical farmers, and the approval of such board obtained.

(b) that no single landowner or small group of owners may be enabled to force an unwanted and even detrimental drainage scheme on neighbouring owners without their consultation and consent.

(c) that the cost of the work will be equitably distributed among the landowners actually benefitted.

(d) that provision be made for payment of compensation to those injuriously affected, and

(e) that Municipalities have power to expropriate areas which it is proposed to drain, when the welfare of the community requires that the area in question should be maintained in its existing state.

The accompanying table shows that a total of 243.43 miles of drains have been constructed on the Ausable Watershed and that, at least $600,000 has been spent on the

---

1. Ontario Royal Commission on Forestry - 1947

Mud Creek Drain, Stephen Township. Very little improvement of the land has resulted from the construction of this drain. The soil is sour, the pasture poor, and it should be restored to woodland.

Walker Drain, Stephen Township. This drain provides field and highway drainage, but due to its gradient has eroded its banks considerably and cost the township money in property damage.

Prance Creek Drain, Middlesex. Considerable sheet and gully erosion has taken place on the farms adjacent to this drain and great difficulty has been experienced in bridging it, as it has widened its channel from the original width of 10 feet to 40 feet in some places.

Big Swamp Drain, Williams East Township.

This drain was started in 1864 and extended in 1872-91-98 and 1908 to its present length of 17,226 feet. It is very doubtful whether the benefits derived from extending it into the Big Swamp have been worthwhile. The upper part of the drain has never been maintained

work. This figure does not give the whole story as records of the costs of the early drains, including "The Cut" constructed by the Canada Company in 1875, were not available. In addition, many Municipal Drains were originally Award Ditches, which have been converted to drains in recent years so that the original cost of construction and maintenance in early years is not included.

Another point worth noting is that the cost of maintenance work is continually rising, for example, in one particular case, a drain, 5 miles long, in Hay Township cost $3,502 to construct in 1910; twenty years later - in 1930, it cost $6,539 to clean out; and fourteen years later, cost another $4,732.

Some drains on the watershed, including improvements to the river channel, have cost as much as $10,000 per mile. When sums as large as this are involved, it would be advisable to have a very careful study made beforehand, by a land use expert, who could decide whether the land to be drained would repay the money expended in increased crop returns.

Every Conservation Authority should investigate any drainage scheme, which is proposed within its boundaries, and have a representative present at the presentation of the engineer's report as provided by Section 2(11a) The Municipal Drainage Act Amended 1949.

Spring source of the Ausable River east of Staffa. No attempt should be made to drain such a spot as this. Cattle should be excluded and the surrounding moraine reforested to preserve the flow.

In certain limestone areas streams flow into crevices of the rock and so maintain underground water tables.

Another spring source near Maple Lodge in McGillivray Township, which should be

MUNICIPAL DRAINS - AUSABLE WATERSHED

COUNTY	TOWNSHIP	NUMBER OF DRAINS	LENGTH IN MILES	COST
HURON	Hay	19	40.29	$ 78,137
	Stephen	19	45.79	95,541
	Tuckersmith	3	6.78	11,919
	Usborne	19	28.23	64,052
MIDDLESEX	Adelaide	3	4.21	8,388
	Biddulph	6	8.89	10,300
	Lobo	0	-	-
	London	1	(included in	Biddulph)
	McGillivray	21	37.18	164,432
	Williams E.	6	12.83	15,435
	Williams W.	7	4.26	6,663
LAMBTON	Bosanquet	24	35.01	134,241
	Warwick	2	3.37	3,461
PERTH	Blanshard	0	-	-
	Hibbert	6	16.59	26,240
TOTALS		136	243.43	$618,809


MUNICIPAL DRAINS
OF THE
AUSABLE RIVER WATERSHED
1947
Ausable NATURAL STREAM CHANNELS
DRAINS AND DITCHES
PROPOSED NEW CUT
SCALE MILES
ONTARIO DEPARTMENT OF PLANNING AND DEVELOPMENT
CONSERVATION BRANCH
LAKE HURON
Smith Lake
ZURICH
HENSALL
EXETER
CENTRALIA
GRAND BEND
DASHWOOD
PARKHILL
THEDFORD
ARKONA
AILSA CRAIG
KIRKTON
Parkhill
Moray Creek
Little
Ausable
River
Nairn
Creek
WATERSHED
BOUNDARY

WILDLIFE

Chapter 1

THE APPROACH TO THE PROBLEM

There are two objectives in planning for wildlife in Southern Ontario. One of these is to retain for the average citizen the opportunity to hunt and fish, within the law, in an attractive environment, and where possible to trap fur for profit. It is only beginning to be recognized that the ability of any piece of land or water to produce an annual yield of game mammals, game birds, fish and fur is a significant part of its capital value. The second objective of wildlife planning is to retain for the average citizen the opportunity to see and enjoy the varied forms of birds, mammals and other wildlife indigenous to the region concerned, in the greatest possible variety.

Land well adapted for wildlife should therefore produce or harbour a permanent population of interesting species and an annual crop of game and fur. These populations should be adapted so that they have no adverse effect on all reasonable farming paractices. The control of harmful species and the maintenance of all other animal populations at a desirable level through the provision of a proper habitat, or living quarters, is a natural branch of good land management. Many other techniques of wildlife management are significant, such as the introduction of new species where needed, and restrictions of the daily and seasonal kill.

But in agricultural southern Ontario and in the Ausable Watershed in particular the amount of good habitat available appears to be the controlling factor in the abundance of wildlife. The two chief requirements for wildlife planning in the area are therefore a study of the existing habitat and a study of the wildlife populations, particularly the dynamics or changes of populations over a period of several seasons. The second requirement cannot possibly be

carried out in a single year's survey. It was therefore decided to concentrate the field work on a few of the more significant problems. The watershed provides a great variety of wildlife habitat, and the streams also vary widely in suitability for fish. A beginning has only recently been made in the basic research on game environments in agricultural southern Ontario. The techniques of stream survey are at present farther advanced. In the present survey the chief detailed work was therefore the stream biology and the environment for fish. Of all other wildlife only two species were chosen for detailed attention. These included the muskrat, which is the most important furbearer, and the meadow mouse, which is potentially harmful to reforested areas and orchards.

The animals found in the Ausable Watershed are a mixture of northern and southern species with ranges which overlap in this area from two of the major life zones in North America, known as the Canadian and Carolinian zones.[1] The Carolinian zone occupies a small part of southern Ontario where a combination of the latitude and the modifying influences of large lakes allows a more southern vegetation and fauna to occur than would otherwise be there. The overlapping ranges in the watershed of the cottontail and cardinal, more southern species, and the varying hare and myrtle warbler, more northern species, are typical examples of the transitional character of the fauna.

---

[1] Lee R. Dice: "The Biotic Provinces of North America," Ann Arbor, Michigan, 1943.

CHAPTER 2

FORMER CONDITIONS

The dense forests which covered the watershed at the time of settlement have already been described in the section of this report devoted to forestry. It is a common belief that there were very great numbers of wildlife in such forests before the white man came. It is unlikely that this is true of more than a few species such as the black or grey squirrel. It appears more probable that the country supported a maximum of game and the larger forms of wildlife some twenty years after the country was first settled. At that time the many forest edges, where cleared fields and both open and closed ungrazed woods offered a wide variety of food and shelter, supported a flourishing population of game, fur and other wild animal life. Gradually the cutting of the remainder of the forest and the extensive trapping and hunting reduced the wildlife population, while the lowering water table cut off the flow from many springs, ending the fish life in the streams they fed.

At least nine species of mammals which formerly must have been found in the watershed no longer occur in it. These are the beaver, porcupine, marten, fisher, wolverine, cougar, Canada lynx, and the Wapiti or American Elk. The same is true of two species of birds, the Passenger Pigeon and the Wild Turkey. Several other species of mammals and birds are remnantal now, occurring rarely if at all. The varying hare or snowshoe rabbit is one of these.

A few records from the early literature will indicate the general situation. Dr. Dunlop, in a report to the Canada Company, dated 1827[1], noted that "beaver meadows, which are numerous, produce enormous quantities of natural hay and pasture." The numbers of beaver were probably greatly reduced even before settlement took place. Deer were once

[1] T. Brymner, Report in Canadian Archives, 1898.

so common that at Strathroy just off the watershed they were "piled like cordwood, and you could take your choice at a dollar each".[1] The Wild Turkey was at the northern edge of its range in the watershed. Turkeys were gone from most of their range in Ontario by 1890.[2] One was reported as having been taken near Sylvan (West Williams Township) in 1900.[3] If authentic this was one of few remaining in Ontario at the time.

The Passenger Pigeon formerly nested in considerable numbers in the watershed. A colony was still nesting in Stephen Township in 1868.[4] This extinct species, whose vast flocks astounded the early settlers in North America, was still present in large numbers in 1860, declined steadily until 1880 and very rapidly thereafter. The last large flight reported in the watershed was at Arkona, Bosanquet Township, in 1872. The extinction of this species probably came as much from the clearing of the land as from the intensive market shooting and trapping.

The Bobwhite or Quail is another species which was once common in some parts of the watershed. The dense forests of southern Ontario were not a favourable site for the Bobwhite, but Charles Fothergill, writing in 1831, recorded that "Thirty years ago the quail was not known in Canada. Now it abounds in the upper province".[5] The many forest edges around the newly cleared land and the abundance of brushy cover favoured the species, which probably reached a peak of population about 1860. The available cover was rapidly reduced and the number of market hunters gradually

---

1 Smith's Canadian Gazetteer, Toronto 1846.
2 C.H.D. Clarke : Sylva Vol. 4 No. 6, 1948.
3 Parkhill Gazette Review, Jan. 18, 1900.
4 Margaret H. Mitchell, "The Passenger Pigeon in Ontario", Contribution #7, Royal Ontario Museum of Zoology.
5 Charles Fothergill, Unpublished Diary 1833, in Royal Ontario Museum of Zoology, Toronto.

increased. The result was inevitable. Overshooting soon reduced the remaining population. Bobwhites have persisted for many years in the watershed in small numbers, but by 1947 they were reported to be reduced to two coveys a few miles west of Parkhill. None were seen in the 1947 watershed survey.

One other species of particular interest to the early pioneer was the Massasauga Rattlesnake. This species still is found both north and south of the watershed, and it is possible that it may still occur in the "Pinery".[1] A larger species, the Timber Rattlesnake may also have formerly occurred in the Ausable Watershed.

The watershed formerly contained an area of very great importance both to migrating and nesting waterfowl. This was a marshy lake reported in 1819 as being six or seven miles long and three or four miles broad.[2]

By 1947 the water of this lake had been reduced by drainage and the lowered water table to "Smith Lake", 314 acres of water surface surrounded by 1200 acres of floating bog and marsh.

While most species of game and fur were steadily diminishing in numbers in the watershed, such open country species as the red fox, skunk and cottontail were increasing. The last named had come in from the west or south and probably had been in the watershed less than eighty years.

---

1 C.W. Nash "Check List of the Vertebrates of Ontario", Toronto, 1905.
2 Report of Lt. Willson, Royal Engineers, Sept. 27, 1819.

CHAPTER 3

STATUS OF PRESENT SPECIES

1. MAMMALS:

There was no intensive attempt during the survey to make a systematic collection of the smaller mammals of the watershed, and little collecting had formerly been carried out in the area. The following list is therefore in part hypothetical. Forty-three species are included, of which twenty-one were taken or observed during the survey. The remainder are included because there are other authentic records or because their ranges surround the watershed and should obviously include it. The eight former species noted in Chapter 2 as no longer occurring in the watershed are not included in the list. The Bay Lynx, Otter and Varying Hare are disappearing from the region but may still occur rarely. The Black Bear is included on the basis of an unsubstantiated report of 1947. Several of the bats listed may occur in the watershed only in migration.

The arrangement and terminology of the list follow those in "A Provisional Check List of the Mammals of Ontario", by S.C. Downing, (Misc. Publication #2, Royal Ontario Museum of Zoology, Toronto, 1948). Mr. Downing was good enough to provide assistance in preparing the list.

Cinereous Shrew	Sorex cinereus Kerr
Smoky Shrew	Sorex funeus Miller
Pigmy Shrew	Microsorex hoyi (Baird)
Mole Shrew	Blarina brevicauda (Say)
Hairy-tailed Mole	Parascalops breweri (Bachman)
Star-nosed Mole	Condylura cristata (Linnaeus)
Little Brown Bat	Myotis lucifugus (LeConte)
Long-eared Brown Bat	Myotis keenii (Merriam)
Silver-haired Bat	Lasionycteris noctivagans (LeConte)
Big Brown Bat	Eptesicus fuscus (Beauvois)
Red Bat	Lasiurus borealis (Muller)

Hoary Bat	Lasiurus cinereus (Beauvois)-Rare.
European Hare	Lepus europaeus Pallas
Varying Hare	Lepus americanus Erxleben Not reported but may still occur rarely.
Cottontail	Sylvilagus floridanus (Allen)
Black or Grey Squirrel	Sciurus carolinensis Gmelin
Red Squirrel	Tamiasciurus hudsonicus (Erxleben)
Woodchuck	Marmota monax (Linnaeus)
Eastern Chipmunk	Tamias striatus (Linnaeus)
Eastern Flying Squirrel	Glaucomys volans (Linnaeus)
Northern Flying Squirrel	Glaucomys sabrinus (Shaw) Probably occurs.
Deer Mouse	Peromyscus maniculatus (Wagner)
White-footed Mouse	Peromyscus leucopus (Rafinesque)
Cooper's Lemming Mouse	Synaptomys cooperi Baird Taken at Thedford in 1935.
Muskrat	Ondatra zibethica (Linnaeus)
Pine Mouse	Pitymys pinetorum (LeConte) Possibly occurs in the "Pinery".
Meadow Mouse	Microtus pennsylvanicus (Ord)
House-Rat	Rattus norvegicus (Erxleben)
House Mouse	Mus musculus Linnaeus
Meadow Jumping Mouse	Zapus hudsonius (Zimmermann)
Brush Wolf	Canis latrans Say A few seen every winter. The first Brush wolf taken in Ontario was recorded at Thedford, Oct.1919[1].
Timber Wolf	Canis lupus Linnaeus Last reported in 1918 when one was said to have been trapped, and the skin sent to Ottawa.
Red Fox	Vulpes fulva (Desmarest)
Grey Fox	Urocyon cinereoargenteus (Schreber) Not recorded but may be expected to occur as it is already well established along the Lake Erie shore.
Black Bear	Ursus americanus Pallas One was reported in 1947 southeast of Bayfield.

---

[1] Reported in Can. Field Naturalist 59 # 4, July 1945.

Raccoon	Procyon lotor (Linnaeus)
Ermine	Mustela erminea Linnaeus
Long-tailed Weasel	Mustela frenata Lichtenstein
Mink	Mustela vison Schreber
Skunk	Mephitis mephitis (Schreber)
Otter	Lutra canadensis (Schreber) May still occur rarely
Bobcat or Bay Lynx	Lynx rufus (Schreber) May still occur rarely
White tailed Deer	Odocoileus virginianus (Boddaert)

2. Birds:

No intensive survey of the birds of the watershed has been made. It is probable, that about 300 species of birds live in or migrate through the watershed, but only about 120 species remain during the summer to nest in the area. The following list of 113 species provides a fairly accurate picture of the birds resident in the watershed in summer. The list is based chiefly on the report of Frankland S. Cook,[1] covering Lambton County only, but species not observed in the watershed itself have not been included. The list has been checked by L. L. Snyder, Assistant Director, Royal Ontario Museum of Zoology. The arrangement and names in the list are from Taverner's "Birds of Canada" (1934). Names followed by a * are those of species which probably do not breed in the watershed although they are summer residents.

Horned Grebe	Mallard Duck
Pied-billed Grebe	Black Duck
Great Blue Heron *	Blue-winged Teal
Green Heron	Wood Duck
Least Bittern	Turkey Vulture
American Bittern	Sharp-shinned Hawk

[1] F. S. Cook "Summer and Migrant Birds of Lambton County, Ontario", observations by F. S. Cook, W. W. H. Gunn and J. K. Reynolds. Unpublished.

Cooper's Hawk
Red-tailed Hawk
Bald Eagle
Marsh Hawk
Osprey
American Sparrow Hawk
Ruffed Grouse
Bobwhite
Common Pheasant
Virginia Rail
Sora Rail
Common Gallinule
Piping Plover
Killdeer Plover
American Woodcock
Upland Plover
Spotted Sandpiper
Herring Gull *
Ring-billed Gull *
Common Tern *
Black Tern
Rock Dove
Mourning Dove
Yellow-billed Cuckoo
Black-billed Cuckoo
American Screech Owl
Great Horned Owl
Whip-poor-will
Nighthawk
Chimney Swift
Ruby-throated Hummingbird
Belted Kingfisher
Yellow-shafted Flicker
Pileated Woodpecker

Red-bellied Woodpecker *
Red-headed Woodpecker
Hairy Woodpecker
Downy Woodpecker
Eastern Kingbird
Crested Flycatcher
Eastern Pheobe
Traill's Flycatcher
Least Flycatcher
Eastern Wood Pewee
Horned Lark
Tree Swallow
Bank Swallow
American Rough-winged Swallow
Barn Swallow
Purple Martin
Blue Jay
American Crow
Black-capped Chickadee
White-breasted Nuthatch
House Wren
Long-billed Marsh Wren
Short-billed Marsh Wren
Catbird
Brown Thrasher
Wood Thrush
American Robin
Wilson's Thrush
Red-breasted Bluebird
Cedar Waxwing
Common Shrike
Common Starling
Yellow-throated Vireo
Red-eyed Vireo

Warbling Vireo
Black and White Warbler
Golden-winged Warbler
Yellow Warbler
Cerulean Warbler
Pine Warbler
Prairie Warbler
Oven-bird
Louisiana Water-Thrush
Mourning Warbler
Maryland Yellow-throat
American Redstart
English Sparrow
Bobolink
Eastern Meadowlark
Red-winged Blackbird
Baltimore Oriole

Crow Blackbird
Cowbird
Scarlet Tanager
Cardinal
Rose-breasted Grosbeak
Indigo Bunting
American Goldfinch
Eastern Towhee
Savannah Sparrow
Grasshopper Sparrow
Henslow's Sparrow
Vesper Sparrow
Chipping Sparrow
Field Sparrow
Song Sparrow
Swamp Sparrow

3. Game and Fur

The extent of woodland cover remaining on the watershed is described in the Forestry section of this report. While woodlands are well scattered over the watershed and there are remarkably few one-thousand-acre blocks without some woodland, the percentage of ungrazed woodland is very low and cover for wildlife is therefore poorer than might be expected. Only 8% of the woodlots are fenced from cattle.

Most of the more desirable species of game and fur are no longer common in the watershed. General statements concerning the populations on so large an area, including eight major soil types and a much greater variety of vegetation types, are apt to be misleading. However, a few notes on the chief species of interest follow:

White-tailed Deer	Common, and heavily hunted even when the season is closed, particularly in Bosanquet Township.
Red Fox	Six trappers all reported this species as common and increasing. One trapper at Clandeboye estimated the average winter population as 2 per square mile.
Raccoon	Common and much increased recently. Its habitat has also increased, since several reports indicated more raccoons are now adapted to living in the "tile" than in trees. One trapper took 20 in 1947, all in "tile".
Skunk	Abundant
Black Squirrel	Common
Red Squirrel	Reported as rare.
Ermine and) Long-tailed Weasel)	Uncommon
European Hare (Jackrabbit)	Abundant
Cottontail	Abundant
Mink	Scarce and has declined recently
Muskrat	(Discussed in a separate chapter of this report)
Woodcock	Common in moist woods in migration. A few are reported as remaining to nest in the reduced habitat now available.
Ruffed Grouse	A remnantal species now rare except in the Pinery. A few pairs remain in the Hay Swamp.

The gradual removal of rail fences has reduced the habitat for farm game. This is a pasture farm near Khiva.

Most of the tributaries are dry in summer. This is a dry water-course near Adelaide.

Good cover for farm game is a rarity in the agricultural lands of the watershed. Concession IV, Lot 8, Usborne Township.

A few ruffed grouse remain in the "Pinery".

Ring-necked Pheasant	Scarcely occurs in the watershed. A few reported near Lucan and in Williams Township.
Hungarian Partridge	A few reported in the 'Klondike' area of the Thedford Marsh.
Bobwhite	Reported to occur 2 miles north-west of Parkhill but not elsewhere in the watershed.
Wilsons Snipe	The species apparently does not breed in the watershed, but a few are found in Bosanquet Township during migration.

Apart from migratory waterfowl the only game species now commonly hunted are the jackrabbit and the cottontail which seem well able to withstand the decimation that occurs over local areas from jackrabbit 'drives'. It is probable that more deer are taken illegally than legally. The watershed includes in Smith Lake one of the best duck marshes in Southern Ontario. The Black Duck, Wood Duck, and Blue-winged Teal all breed in this marsh. Apart from this area, and the lakes and old river course near Port Frank, the watershed supplies little satisfactory habitat for ducks. Smith Lake is described in a separate chapter.

4. Species of Significance to Agriculture and Forestry

The chief species which come under this heading are the Crow, Starling, Groundhog, the White-Tailed Deer, the Cottontail and the Meadow Mouse. The American Crow is generally considered a serious pest in the watershed. Extensive investigation by the United States Biological Survey has shown that, at least in that country, it does about as much good as harm in an agricultural community, since insects form a large part of its food. All authorities agree that the Starling is a damaging species, but there is at present no efficient and cheap method of control. The Groundhog and Cottontail are

frequently and rightly condemned, but the fact is that few farmers bother to shoot these species although this is a simple solution. The greatest damage from deer comes to root crops, but few reports were made during the survey indicating that deer are a serious problem in the watershed.

The two species most likely to affect tree plantations are the Cottontail and the Meadow Mouse. The Cottontail has been known to destroy large stands of young hardwoods. A series of experiments is now under way in the University of Toronto to test the efficiency of various sprayable deterrents against the Cottontail. The Meadow Mouse is discussed in a separate chapter.

5. Species of Spectacular Interest

Sportsmen and professional trappers make up only a small proportion of those who live in or visit the watershed. The casual observation of the larger and more spectacular forms of wildlife provides great interest to a large group of average citizens, whether farmers or town dwellers. Notes on some of the more interesting species follow.

Most important is the White-tailed Deer, which has noticeably increased in numbers in recent years. In Lambton the situation has been summarized as follows:[1] "The long-term trends in land use are mainly in a direction reducing avail able deer range. If deer numbers continue to increase and deer range continues to be reduced at present rates, browsing damage and even appreciable crop damage is not unlikely". This summary appears to be accurate and to apply equally well to the whole Ausable Watershed. The hunting of deer by "jacklighting" is said to be common in the Thedford marsh area.

Most of the larger and more spectacular birds that nest in the watershed are now present in very small numbers. They include amongst others the following species.

[1] W.H.H. Gunn, K. Reynolds, R. Braffette, F.S.Cook, B. Shindman, "Advance Report on Wildlife Conditions in Lambton County, 1947, published by Dept. of Lands and Forests, Province of Ontario.

Bald Eagle - Eagles are now a rarity in Southern Ontario. A single pair returns each year to nest in the "Pinery". This pair raised the usual two young in 1947.

Turkey Vulture- This species is common in the watershed and is said to nest in the vicinity of Smith Lake.

Great Blue Heron- A few of these were seen during the summer but no heronry was reported in the watershed.

One small species, the Prairie Warbler, is of particular interest in the watershed because very few nesting colonies are known in Ontario. A dense colony occurs in the narrow zone of Red Cedar and Juniper which fringes the dunes between Port Frank and Grand Bend. About 50 pairs per mile of shore were present in the summer of 1947.

Chapter 4

IMPROVING THE FARM FOR WILDLIFE

Recommendations for specific improvements for individual farms in the Ausable Watershed would involve detailed examination beyond the scope of the present survey. Moreover the only farms which can be improved for wildlife are those where the farmer or landowner is interested himself in doing so. Many farmers may wish to improve land for wildlife quite apart from any revenue they may receive from game or fur; others may do so because they know that since pioneer times, and particularly near cities and towns, the supply of game has never yet exceeded the demand and is not likely ever to do so, and there is no reason why a farmer should not receive remuneration to cover his costs of wildlife improvement work.

1. Woodlands

The elimination of grazing of woodlots would be the most useful single measure in improving the wildlife environment. Large-scale reforestation plans are included in the Forestry report. In plantations, up to about the tenth year from planting, the entire planted area is valuable for wildlife. But large blocks of coniferous trees will, at least after the twelfth year from planting, have little or no undergrowth and will, apart from their edges, be entirely sterile as far as upland game and most forms of wildlife are concerned. The chief improvements to be expected will therefore come from good management of the farm woodlot. Selective cutting is both sound forestry practice and good planning for wildlife. Landowners who have woodlots in which the crown canopy has closed over considerable areas, and who wish to produce a proper environment for wildlife, will find that release cuttings, slashings to stimulate sprout growth, thinnings and felling timber for sale will improve rather than retard the carrying

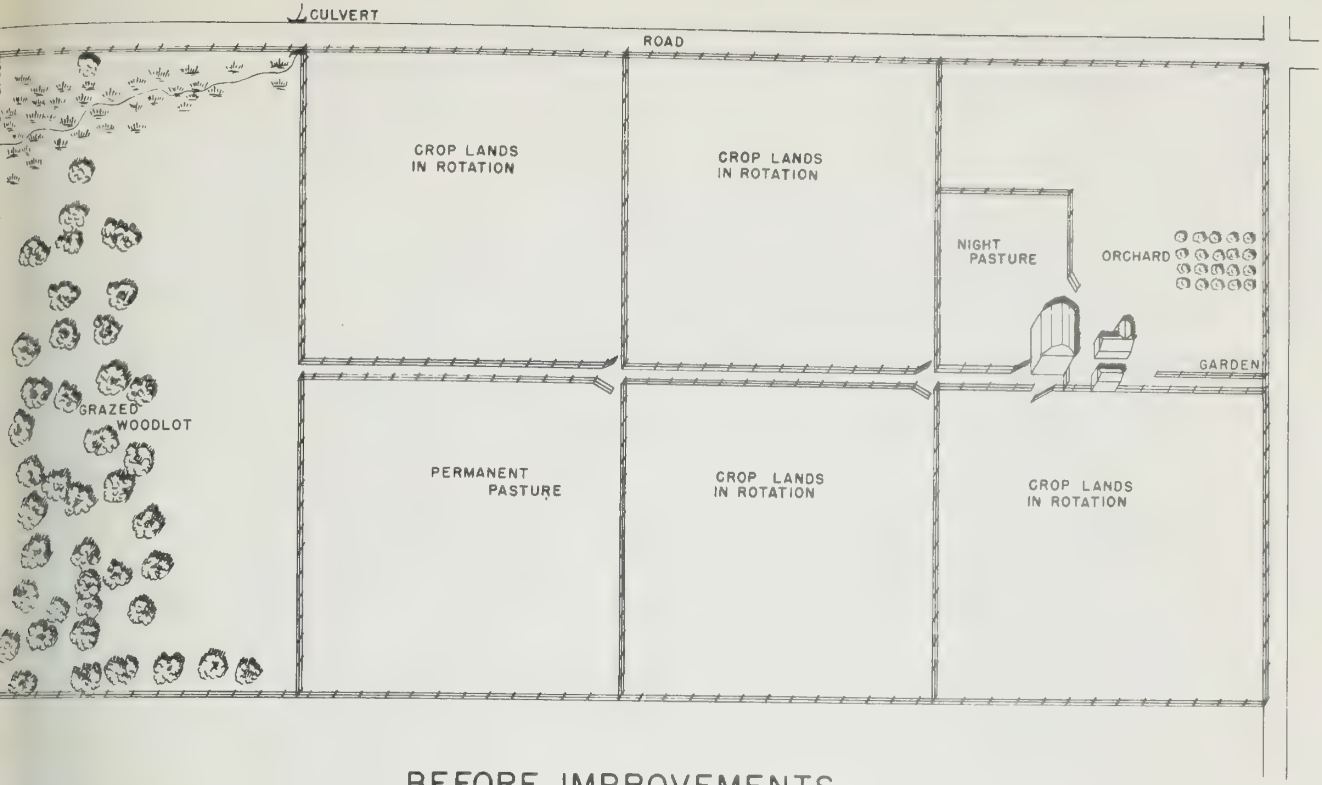
capacity for wildlife. Where hollow trees, useless for lumber, are using up the woodlot space, they can be girdled rather than felled and will then continue to provide dens for raccoons, squirrels and other valuable or interesting species. Construction of brush piles from cuttings is recommended where rabbits are desired, two or three such brush piles per acre being the normal spacing.

2. Cultivation Practices

All good farming practices which make a more luxuriant vegetation will improve the farm environment for wildlife. A few special practices will give more specific benefits. Strip-cropping, described elsewhere in this report, is of particular value since by this means no extensive area is denuded of cover at one time by harvesting. In the less flat parts of the watershed, filter strips, either above water diversion terraces or used as emergency waterways provide travel lanes and nesting cover for wildlife. Cover crops such as the clovers provide a habitat and food for wildlife in areas that would otherwise be barren during the winter months. The elimination of brushy fencerows is now the rule rather than the exception on Southern Ontario farms. Those who are interested in wildlife improvement will find that the inclusion of a few field boundary hedges on the farm will moderate the effect of winds on crops, serve as travel lanes and cover for wildlife, and harbor large numbers of songbirds which help to control insect pests. Rosa multiflora is an excellent hedge-forming shrub. It is proof against cattle and hogs, provides excellent cover and food, and does not exhaust the nearby cultivated ground.

3. Food and Cover Patches

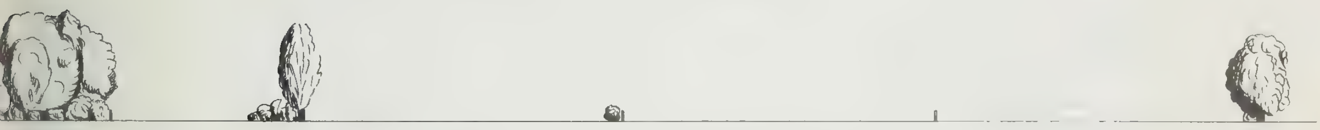
Field corners are frequently barren of crops. Any fence crossing therefore which embraces the corners of four fields may be made into a haven for ground nesting species by planting a few trees and shrubs and protecting them. It is



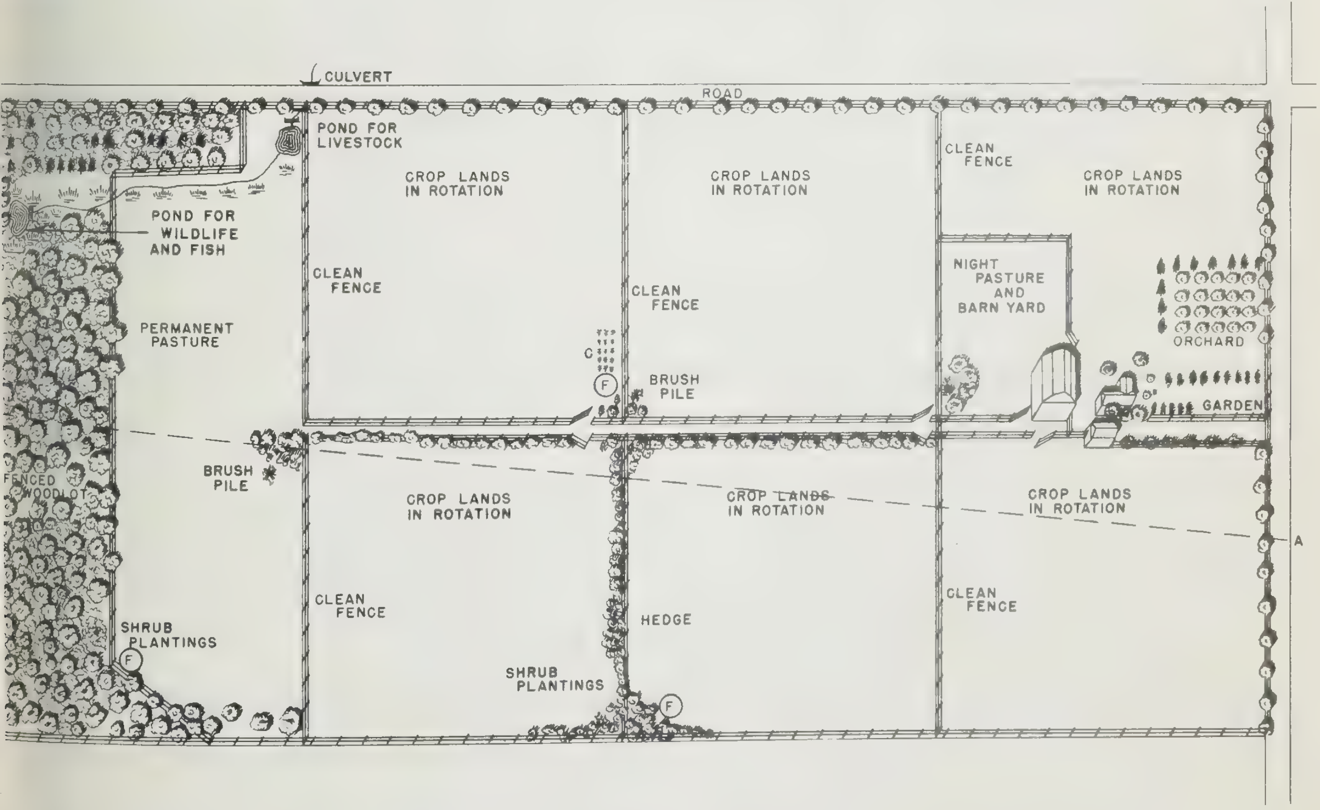
BEFORE IMPROVEMENTS

SHORTAGE OF COVER AND FOOD FOR WILDLIFE.

NO PONDS
GRAZED WOODS
NO NESTING SITES
NO WINTER FEEDING STATIONS



PROFILE THROUGH A-A

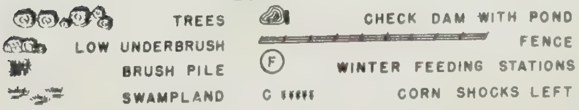


AFTER IMPROVEMENTS

COVER AND WILDLIFE FOOD PATCHES SUPPLIED.

FENCED UNGRAZED WOODLOT
PONDS
WINDBREAKS
BRUSHPILES
WINTER FEEDING STATIONS
GAME LANES (HEDGES)

LEGEND



important to rid such areas of useless weeds by crowding them out with either berry bushes, plum thickets and sweet clover or the normal climax type of open vegetation which is blue-grass.

The watershed provides only marginal territory for the Ringnecked Pheasant. With artificial winter feeding pheasants could survive most winters but periodic winter killing of the entire population might be expected.[1] Those who wish to protect this species should provide food patches to supplement the available diet of seeds of ragweed and other low plants. Short rows of standing corn or corn in shocks should be left close to good cover. Yellow corn is the more useful type because of its high vitamin "A" content. Buckwheat, soybeans and Japanese millet are also recommended. Disused rolls of fence wire left at the edges of woodlands provide very acceptable cover. It need hardly be added that any gullied area in which groups of evergreen trees are planted is of value to wildlife.

4. Ponds and Streams

The importance of water to wildlife is often forgotten. Many farms have at least one low spot where a small amount of work with a scoop will provide a dam and a pond to provide nesting and feeding sites for water and marsh birds. If possible ponds for wildlife should be separate from those for cattle or for fish. Alder and willow cuttings pushed in the ground around such a hollow will rapidly provide wildlife cover. New water areas will rapidly be invaded by aquatic plants, but additional species may have to be introduced. No duck food studies have been made in Southern Ontario. Wild rice may be introduced but since it is not well adapted to wide variations in water levels, being often sterile in

1. C.H.D. Clarke and R. Braffette, "Ringnecked Pheasant Investigations in Ontario, 1946". Department of Lands and Forests, Ontario.

fluctuating waters, it cannot be considered as certain to succeed. The idea has long been current and is fostered by many sportsmen's organizations, that the planting of wild rice is the answer to the problem of how to attract ducks to any area. The fact is that wild rice is of no significance to ducks in Canada except in the fall, and does not provide cover or nesting sites. The following species which may be easily obtained are recommended as certain to be valuable duck foods. If none of them occur in ponds or shallows with good cover for ducks they should be introduced.

Sago Pondweed	(Potamogeton pectinatus L.)
Clasping-leaved Pondweed	(Potamogeton perfoliatus L.)
Wild Millet	(Echinochloa Crusgalli (L) Beauv)
Japanese Millet	(Echinochloa frumentacea (Roxb.)Link)
Wild Celery	(Vallisneria spiralis L.)
Knotweed	(Polygonum pennsylvanicum L.)
Smartweed	(Polygonum muhlenbergii (Meisn.)Watts)
Bulrush	(Scirpus americanus Pers.)
Bulrush	(Scirpus acutus (Muhl.)

The improvements of ponds for muskrats is discussed in a separate chapter of this report, and farm fish ponds are discussed in the chapter concerning fish.

CHAPTER 5

DETAILED STUDIES - THE MUSKRAT

The following report is based on examination of most of the river and its tributaries and on interviews with forty-five trappers, fur-buyers and other residents. The game over-seers of the Fish and Wildlife Service of the Department of Lands and Forests added much valuable information. Some trapping was done.

The streams of the Ausable Watershed are not high in muskrat production, nor have they a very high potential even if improved. Much of the river is fast-flowing; its banks of till, clay or sand are steep and bare and the bed is of rock and gravel. Little vegetation is present in these areas to feed the animals which might live in the banks. The headwater streams although small are in comparatively flat land, and have more vegetation present. They therefore support almost as many muskrats as the larger fast-flowing sections.

1. Requirements of Muskrat Populations

The present status of muskrats in the watershed can be best examined if the critical requirements of the species are kept in mind. While all the factors which affect the lives and populations of muskrats are not fully understood, it is generally agreed that the most essential needs are the following:

(a) Abundant aquatic and semi-aquatic vegetation;

(b) Permanent water for protection and escape, and to provide winter food;

(c) Home sites, either expanses of marsh for houses or banks of clay or loam for burrows;

(d) Adequate breeding stock after the trapping season.

The most important muskrat food is the Cat-tail (Typha angustifolia and latifolia), of which the lower part of the stem is eaten in summer, and the rootstock in winter, and the stem is used in constructing winter houses. This plant is

found abundantly in only a few restricted parts of the watershed.

Water lily (Nuphar advena, Nymphea odorata), rhizomes and leaves, or Wapato (Sagittaria sp.) leaves and tubers, may be the main source of food in some places. Other plants eaten on the Ausable include: wild rice (Zizania aquatica), pondweeds such as Potamogetons, Polygonums, Elodea, Myriophyllum; round stem bulrush (Scirpus acutus, S. Validus), willow (Salix), farm crops of apples, oats, wheat and corn; grasses and sedges; and clams, fish, and crayfish, are sometimes eaten.

In order to overwinter, muskrats must have either a typical mound of vegetation or 'rat house' with a nest inside, or a bank burrow, in either case with an entrance below the ice.

At the breakup of the ice in spring, the muskrat mating season or 'run' occurs, lasting for about ten days. At this time the male is very active, travels long distances and is easily caught. After the run, signs of the animals become scarce. Females build nests in preparation for their litters and seem to restrict their activities to a small area. Extended trapping invariably removes pregnant females.

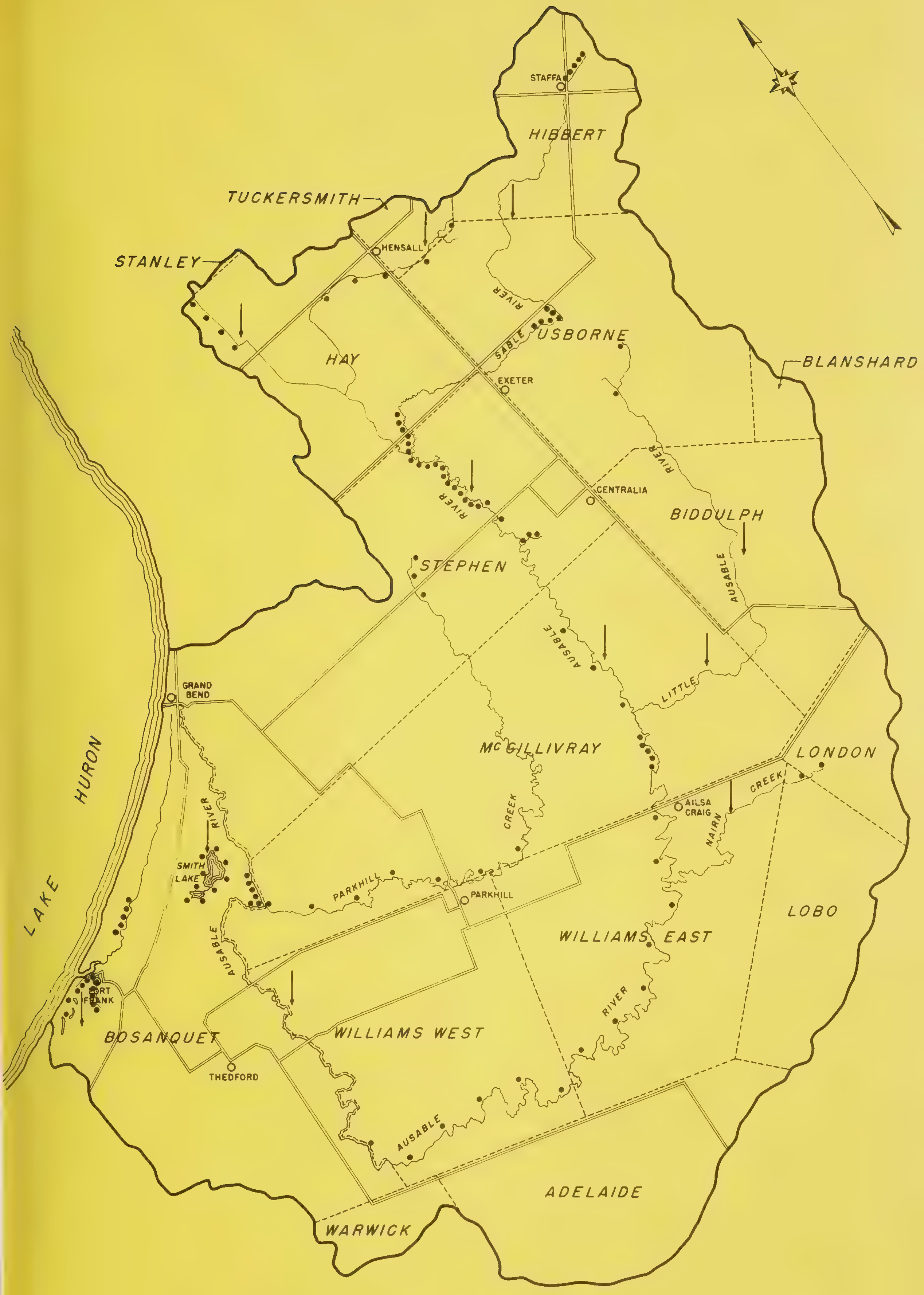
The first litter arrives usually in May, usually from six to eight. Muskrats are believed to have two or possibly three litters per season in this locality.

Sudden late spring floods are apt to trap and drown litters in the nest.

2. Muskrat Numbers on the Ausable Watershed

Most of the trappers interviewed in the watershed indicated that there has been a serious and continuous decline in the population, accelerated in the last two years by the high prices of pelts.

To express this decline quantitatively and indicate its generality, examples of catches representing the



MUSKRAT YIELDS

CATCH PER MILE OF RIVER IN 1947

••••••• ------------- MORE THAN 25

• • • • •------------ 15 TO 25

• • • •--------- 5 TO 15

UNMARKED --------- LESS THAN 5

REPORTS OF SPEARING MUSKRATS -- ↓

SCALE: MILES

1 0 1 2 3 4 5

whole watershed are given. A trapper near Hensall, from 1944 to 1947, made these successive catches; 125, 118, 90, 65. At Crediton 27, 14 and 9 were taken since 1945. Along Mud Creek where 90 were taken in 1945, 40 were taken in 1947. Similarly at Nairn Creek, Ailsa Craig, Smith Lake, Old Ausable, where 100, 150, 400, 150 used to be taken, the latest catches were 6, 60, 125 and 30 respectively. A local fur-buyer, who used to purchase about 1000 pelts annually before 1943, had only 800 in 1945 and 200 in 1947.

3. Factors Causing the Decline

The main reasons offered for the serious decline in muskrat numbers were illegal trapping and the rigid fixing of the trapping dates in advance of the actual season. But since neither of these conditions could be considered to be new, the cause is either more obscure or else it is the incentive of high prices of the pelts, causing more illegal trapping than is normal. The general reaction after the trapping season of 1947 may be gauged from a typical statement - "I've never in my life seen so few muskrats as there are this year." The clearest indication of the low population was the general agreement amongst trappers that the conditions would be improved if the season were closed for a year.

(a) Overtrapping: That muskrats will prosper in spite of severe trapping is a widespread belief, but Storer (1938) reports that in European countries such as England where burrowing in canals and dikes makes them objectionable, trapping alone has controlled muskrat outbreaks and made extermination probable.

Some trappers feel that extermination is similarly probable on the Ausable. Along the old river course in the 'Pinery', there is an abundance of food (cat-tail, water-lily, bulrush, myriophyllum and other species) in comparatively stable water of a depth of one to three feet. Banks six feet high held by tree roots are suitable for burrowing. In this

superior type of habitat one trapper used to take 150 pelts annually, but the present population he estimates at not more than thirty animals and attributes this solely to illegal trapping.

(b) Spearing and Digging: Eighty per cent of the trappers consulted considered illegal trapping by some of the Stony Point Reserve Indians a major detriment. Reports of their spearing houses, digging burrows, and trapping out of season were advanced with bitterness from every corner of the watershed. (See Map).

Spearing occurs where muskrats build houses. The house is approached quietly and the spear is rammed into the house. If the spear moves, the house is torn open to secure the rat speared. In this lies the extensive waste of muskrats, for under every house is an open plunge hole which must remain unfrozen to give the animal access to the vegetation in the water below. A small hole can be plugged rapidly by remaining inhabitants, but when the cabin is broken down the plunge hold freezes and the muskrat has no way of reaching its feeding grounds. Few muskrats survive this situation. A single unprime skin worth perhaps two-thirds the spring price may be secured, and any other rats in the house will normally die from starvation, freezing, or as victims of mink, dogs, foxes or owls.

Occasionally some attempt is made to secure more than one animal by chopping all houses in a small area to the ice line and having a number of men sitting one at each hole with a spear. As each animal shows its nose it is speared. With such methods little breeding stock can be left and the population declines rapidly. Muskrats are sometimes taken in a similar manner from bank burrows.

Law enforcement is a difficult undertaking on the Ausable Watershed. Because of the large area which Enforcement Officers have to oversee, many trappers do not know the Game Overseer. As a result not only spearing and digging as described above, but also trapping without a license, trapping

out of season, setting traps on houses and in holes, and stealing of traps, all are common.

(c) The Trapping Season: Obviously a harvester of pelts should leave a breeding stock sufficient to maintain as high a population as the habitat will support. Taking a high ratio of females or kits is the usual indication that trapping should cease, but where there are several trappers competing with each other, the end of the season is the only "stop" sign they observe. Most trappers realize the foolishness of it but where several men are trapping, each one reasons that if he does not catch the last few rats, some one else will -- so he continues. Thus in long seasons all traps are out till the last day and breeding stock suffers.

During the "run" animals are easily trapped, a high percentage of the catch is male, and the least number of man hours per pelt is required at this time. With the advance of the season the animals are less active and less easily caught, and traps are set closer to houses and runways, consequently many females are caught, often containing embryos.

Complaints about lengthy seasons came from all along the river - from Exeter, Crediton, Clandeboye, Ailsa Craig, Parkhill, Port Franks, and other places. The season is opened when the ice is thick - sometimes a month before any trapping can be done; and may be extended long after a judicious harvest has been taken.

It seems almost unanimous amongst those interested in muskrats in this area that the season should be closed for a year to allow the population to become well-established. After this a trapping season of approximately 10 days should be inaugurated. The consensus of opinion appeared to be that the season should be opened by an overseer or even more local authority, at the spring break-up, not before; and should be closed in 10 days or when reports are made to him by trappers that the run is over or that a high percentage of females or kits is being taken.

Much of the upper course of the main Ausable provides good muskrat habitat, but cattails are too scarce and winter food is limited.

The old Ausable in the "Pinery". Overtrapping has reduced the muskrats almost to extinction where they were once abundant.

Smith Lake would be a paradise for muskrats, but is periodically flooded and overtrapped.

The lagoons at Port Franks are also overtrapped and severely flooded every spring.

Trappers would appreciate and cooperate with such a scheme. It would require supervision and an acquaintance with the muskrat population during the whole year.

The success of such a measure is illustrated by three localities where it is in operation.

A four acre marsh on the Ausable Watershed trapped carefully by one man has been yielding about 30 pelts per year. In spite of the marked general decline in all surrounding areas, this small marsh, in 1947, had a slightly higher production of 35 pelts. The privately owned 1250 acre marsh of Mr. Bradley near Chatham, Ontario, has shown no decrease in the past two years. On the South Nation River where muskrat numbers have dropped rapidly in the past two years, one man with several miles of creeks, has built up his catch to double the number he took in 1945 simply by refusing to trap out his breeding stock.

The mink is usually termed the muskrat's worst wild enemy, and most trappers have observed signs of its depredations upon the muskrat. Only in two localities was the effect of mink considered significant. Along the Ausable in a stony section below Brinsley, three good mink sets in 1¼ miles were noted by one trapper and each set had a muskrat carcass present.

A trapper at Parkhill claims that along the Parkhill Creek he has built up the muskrat population by reducing the mink. In 1931 he took only 15 muskrats in 7 miles. By 1940 he had removed all the mink and took 44 muskrats in 6 days from one small swamp. In 1946 he took 8 mink from 1¼ miles so is expecting an increase in muskrat numbers.

4. Possible Improvement

Two of the most serious drawbacks to maximum muskrat production have now been discussed. These are the problem of law enforcement in a community where there are very many trappers each taking only a small catch, and the problem of the uncontrolled effects of climate on a fixed trapping season. There is no simple solution to these questions.

Assuming that strict enforcement of the law is a possibility, the establishment of small reservations or restricted areas where muskrats could breed unmolested, and from which they would spread in the spring and fall dispersal is generally favoured. Near Centralia there is an 8 acre marsh, the centre of which is inaccessable by wading or canoe and so is naturally protected. According to several trappers of this region it acts as a feeder to keep the near-by river well stocked.

Several lots on the Ausable near Hensall were at one time closed to trapping and in these years it is claimed there was a notable improvement in the catch from the adjacent streams.

Besides these protective measures habitat improvement might be carried out. The chief effects of the draining of swamps are described in the Land Use and Forestry sections of this report. Sudden and severe spring or summer freshets undoubtedly drown many young in their nests. Marshes and swampy areas provide a retreat and breeding grounds for flooded river animals. Here the water level is more stable, ample food is present, and the muskrats frequently stay most of the summer raising their litters. As the marshes dry in the late summer the muskrats return to the river where at least pools are to be found.

Where lowlying source areas are acquired by the authority for river control and the improvement of ground water, some consideration should be given to the building of low inexpensive dams in suitable locations so as to renew or enlarge any former marshes which are now marginal or submarginal agricultural land. Because they are not usually managed so as to give a high and sustained yield, muskrats are usually looked upon as an almost insignificant supplementary income. On submarginal agricultural land, with proper management, they can be an important income producer. One such location occurs

in the second concession south of Brinsley, where a spring creek could be easily dammed to extend its marshy borders. There are many other creeks and river valleys, at present only poor pasture, where the water could be raised eight to ten feet to create conditions which would encourage fish and wildlife. One of the few places where ducks are to be found, and where muskrats are fairly abundant, is at a small pond formed by a six foot dam in Nairn Creek near Denfield.

What appears to be an excellent site for wildlife improvement and preservation is the block composed of lots 11 - 15, Con. V and VI McGillivray Township. This $1\frac{1}{4}$ mile square is now mainly poor pasture - little more than 100 acres are under cultivation. There is considerable bog land and much of the rest is hawthorn covered. The few quail remaining in the watershed are said to be in this concession. This area is already recommended for acquisition for reforestation as an important stream source area in the Forestry section of this report.

The muskrat population of the Smith Lake marsh is discussed in a separate chapter.

5. Summary

The typical effect of poor management of muskrats by the owner or trapper is shown in the marked decline in their numbers in recent years. Reports of greater numbers from similar habitat in former years, and the fat healthy animals taken lately, indicate that the population is well below the carrying capacity of the river.

Ignoring the Smith Lake marshes, at least 2000 - 2500 additional pelts could be taken annually by reducing the spearing and digging out of muskrats and by closer supervision from fall to spring, plus the adoption of a trapping season regulated according to animal numbers so that the breeding stock is preserved.

Other improvements that might be made are the

establishment of well spaced restricted areas, the restoration of marsh-like headwater streams by small dams, and the improvement of bank cover by tree and shrub planting along stream banks, and by the elimination of pasturing of stream banks.

CHAPTER 6

DETAILED STUDIES - THE MEADOW MOUSE

Most people are aware of the damage which the meadow mouse (Microtus pennsylvanicus) can inflict on young orchard trees. An equally serious problem is the damage, caused by the same species, to the young trees in reforestation projects and nurseries. Both hardwood and softwood plantations are affected, and in times of abundance the mice will eat the bark, leaves and small twigs of almost any tree species, usually destroying the trees by girdling. Since large areas of the Ausable Watershed are being recommended for reforestation, an examination of the present Microtus population on the watershed was made. A few examples will indicate the damage which has already occurred in other places. On one farm near Toronto (Con. VII, Lot 3, King Township, York County) 60,000 trees were planted in 1938 and 1939. Of these an estimated 45,000 or 75% were killed by mice during the winter and early spring of 1942-43 and 1944-45. Much of this area had to be replanted, some of it twice. A plantation at Norval also had to be replanted twice.

Similar devastation has occurred in small local outbreaks in many parts of Ontario. Large scale reforestation schemes in Scotland and continental Europe have been seriously upset in recent years, where mice of the same genus although of a different species are responsible.

Examples are not lacking on the Ausable Watershed, although little reforestation has been done there. Severe damage by mice to plantations occurred on the "Haig" farm near Grand Bend in 1935. In the winter of 1947-8 on a farm near Exeter, Huron County, 95% of the trees in a plantation of 25 acres were girdled and killed in a few weeks by meadow mice.

Many control measures have been suggested and tried out but at present there is no entirely satisfactory economic method of preventing mouse damage. In some ways the problem in this country appears to differ somewhat from that in other countries. From the meagre trapping data available, serious damage appears to occur not only in years when the Microtus population is at a peak, but also when it is relatively low. This is probably due to our more severe winters and their effect on the available food supply, especially in early spring. The most dangerous period is probably at this time when alternate thawing and freezing melts the snow and then freezes the saturated ground, so that subterraneous food supplies, both stores and roots, are unavailable to the mice.

One authority believes that there is a regular four year cycle in the population of this species in New York State, the peaks being reported as occurring in 1920, 1924, 1928, 1932 and 1936.[1] The peaks in Northern Ohio are recorded as 1929, 1932, 1935 and 1938.[2] Little is known of the cycle of abundance in this species in Southern Ontario. The returns on the state and change of the meadow mouse population since 1937 received in questionaires circulated by the Royal Ontario Museum of Zoology show no signs of a widespread uniform population cycle in Southern Ontario. (These returns are based on general observations unsubstantiated by live or dead trapping.) The four year cycles may therefore be of local significance only, as they are affected by so many variables such as depth of snow, disease, predator abundance, food supply and weather.

1. <u>1947 Population</u>

Meadow mice are scarce in most parts of the watershed in 1947. In order to test the validity of general

---

[1] W.J. Hamilton: "Field Mouse and Rabbit Control in New York Orchards", Cornell Extension Service Bulletin # 338.

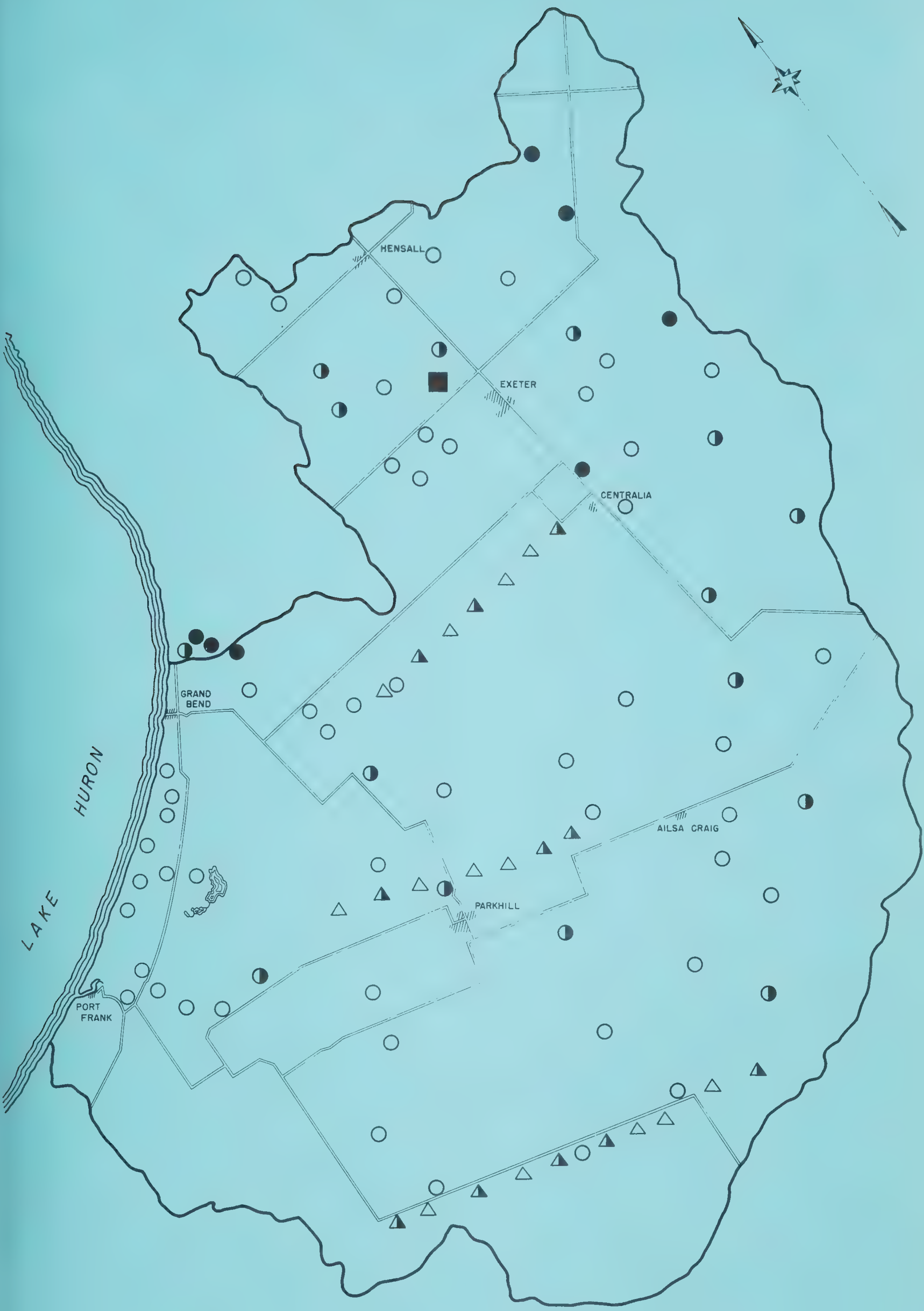
[2] B.P. Bole: "The Quadrat Method of Studying Small Mammal populations", Science Publications of Cleveland Museum of Natural History # 4.

observations made over the entire watershed, standard traplines, each consisting of 50 snapback traps at two yard intervals were laid in 73 stations in the watershed considered to be possible Microtus habitat. The location of the traplines and the results of the trapping are shown on the accompanying map. It will be seen that of 73 lines set out 51 caught no mice. The actual catch totalled only 52 divided as follows:

	Male	Female
Immature	17	8
Adult	21	6

This indicated an exceptionally low population. Meadow mice appeared to be more common in the area north of Grand Bend and in the north-eastern part of the watershed. An additional check was made by careful examination of 24 selected areas which were classified according to the number of runways seen. In 13 of the 24 areas no signs of meadow mice were found.

The plantation near Exeter which was badly damaged in the winter of 1947-48 deserves particular mention, since it occurs on poorly drained sand. Several large areas of this type of land are recommended for acquisition for reforestation in the Forestry section of the report. Of four traplines set out within two miles of this plantation in 1947, three gave no catch and on one a single mouse was caught. The area had not been cultivated for more than 10 years. It is probable that the main increase in the population occurred late in the fall of 1947. In this 15 acre plantation, (1760 trees per acre) only 5% of the trees remained alive and ungirdled by the spring of 1948. It is quite clear that to reforest any area having long grass and weeds without protecting it from meadow mice is to invite disaster. A dense mat of tall grasses or sedges is the preferred range of the meadow mouse. Both idle poorly drained sand lands and muck areas covered with willow scrub or similar vegetation can support



OCCURRENCE OF MEADOW MICE 1947

LEGEND

AREAS EXAMINED AND TRAPPED
- NO CATCH
- 1 OR 2 CAUGHT
- 3 OR MORE CAUGHT

AREAS EXAMINED ONLY
- NO SIGNS
- FEW RUNWAYS
- MANY RUNWAYS

LOCATION OF SEVERE WINTER DAMAGE TO PLANTATION IN 1947-8

EACH CIRCLE REPRESENTS 50 SNAP-BACK TRAPS SET 48 HOURS

SCALE-MILES

1 0 1 2 3 4 5

large populations of meadow mice. Even plantations on well drained sandy slopes with low grasses are vulnerable if they adjoin low areas of long grass and sedges.

2. Control Measures

There are two main approaches to the problem of decreasing the damage caused by field mice to plantations of young trees. The first is to kill the mice. The second is to protect the trees from mouse damage by repellents, wire guards or clearing of suitable habitat.

The first alternative, in most cases, is probably the less satisfactory of the two. Killing off all the mice in an area is extremely difficult and since they repopulate the area very quickly the work would have to be done more than once in a single winter.

Reducing the mice to a minimum population can sometimes have serious effects if coniferous trees are being planted. In at least one instance, (Hatt, Roosevelt Wildlife Bulletin, 1930), Microtus are considered to have been responsible for controlling and largely preventing a serious outbreak of the larch saw-fly (Nematus erichsonii). The insect diet of these mice is by no means limited to saw-flies, and they probably take other injurious insect pests also. In addition, mice are what Elton[1] refers to as a "key industry", forming a large part of the food of many mammals and birds of spectacular and economic value. Any serious reduction in the number of field mice over such large areas as are being recommended for reforestation might have serious repercussions on other forms of wildlife. In years of peak abundance such methods are a necessity and for this reason investigation of methods of this type should be carried out. However, from the meagre data available on damage by Microtus to young trees in Ontario, it appears that damage occurs not only in years when the mice are abundant, but also when their populations are normal or relatively low.

---

1 Charles Elton, "Mice Voles and Lemmings", Oxford University Press 1941.

The second of these alternatives, protection of the trees until they are 8 to 10 years old, will probably in the long run prove to be more satisfactory.

Control measures which involve killing the mice include:

1. Protection of natural predators
2. Use of poison
3. Biological control
4. Various other methods such as gassing, flooding, and the use of cats, dogs or ferrets, which are not practically applicable to the large areas in which reforestation is recommended.

Control measures involving protection of the trees include:

1. Clean cultivation of the ground prior to planting
2. Cutting and removal of grass, at least semi-annually in areas where mice are present.
3. Repellents.

(a) Natural Predators: The animals native in Ontario in which Microtus forms a substantial part of the diet include the larger snakes (pilot snake, fox snake, milk snake, rattlesnake) all the hawks other than the Accipiters, all the common owls, and the shrew, weasel, skunk, fox and coyote. (For example examination of several hundreds of the "pellets" disgorged by the snowy owl, made in 1945 by the Royal Ontario Museum of Zoology, showed that over 90% of its food consists of meadow mice and deer mice). No data are available on how effective these animals are in controlling the mouse population either in normal or peak years of abundance. In many outbreaks of Microtus it has been noted that predators do become more abundant. Most authorities are agreed that the sudden and devastating decrease in numbers of mice could not be due entirely to increased predator pressure but a proper balance between predators and the mice would help to prevent

the mice from increasing too quickly. The only species of Ontario hawks which take a high percentage of poultry and large game birds are the Goshawk, the Cooper's Hawk and occasionally the Marsh Hawk. Of these the Goshawk is rare even in migration. Although poultry farmers are probably justified in destroying the Cooper's Hawk and the Marsh Hawk, the average farmer will benefit by allowing all hawks to feed on the mice in his fields.

(b) Poison: Several different poisons have been used against mice, the chief of which are strychnine, used on crushed grain, and arsenic-poisoned apples, carrots or sweet potatoes. Strychnined oats are most widely used because they last longer than fresh bait. The oats (or barley or alfalfa) are steam rolled to permit the poison to coat the kernel effectively. The effectiveness of the bait over any length of time is increased by placing it in tin cans, tiles or pint milk bottles where rain cannot get at it. These bait stations are also rendered more effective if they are placed in the runways of the mice instead of out in the open, or around the bases of trees. Carrot cubes poisoned with arsenic, while less durable than strychnined oats, are more acceptable to the mice and therefore probably more effective. These baits are distributed by dropping single baits in the runways of the mice.

Poisoning is at present probably the only means of removing a large population of mice. Its effectiveness could be much increased by detailed experiments on kinds of poison used, distribution and density required. A research programme to investigate the possibility of using sprayable poisons such as D.D.T. might lead in the end to a more economic method of getting rid of the mice.

(c) Biological Control: This field is by no means a new one to science, but it has never been actively experimented with on this side of the Atlantic. In 1893 Danysz in France succeeded in infecting a large population of mice with a strain of bacteria which destroyed the mice. This control method is dangerous until exhaustive experiments have been carried out to prove that it is harmless except to the mice. Before it could be used on this side of the Atlantic such experiments

would have to be carried out as well as further studies on the effect of temperature and climatic conditions on its effectiveness and on the density of distribution necessary.

3. Recommendations:

(a) The simplest and cheapest aid to the control of mouse populations is the protection of mouse predators. The public should therefore be educated to the value of any or all of the following species in and around tree plantations: birds such as the Marsh Hawk, Red-tailed Hawk, Red-shouldered Hawk, Rough-legged Hawk, Long-eared Owl, Short-eared Owl, Barred Owl, Screech Owl, Great Horned Owl, Snowy Owl and the Shrikes; mammals such as the weasel, skunk and fox; and snakes such as the Pilot Black Snake, Fox Snake and Milk Snake.

(b) Clean cultivation should be practised prior to planting, and also the cutting and removal of weeds and grass from plantations until all danger of mouse damage is past (trees 8 - 11 years old), in areas of suitable habitat.

(c) Investigation should be made of the population dynamics of Microtus on a single or on several study areas over a period of years. The area selected should be such that normal periodic fluctuations can be studied uninfluenced by the unnatural conditions produced by man in the interests of agriculture. Such an investigation would enable forecasts of population peaks.

(d) A survey should be made of all areas to be reforested and areas adjacent to them immediately prior to planting, to determine the state and trend of Microtus populations, and the extent of suitable habitat. A check should be maintained on these areas until the trees are 8 - 11 years old.

Each of the Source Areas recommended for acquisition and reforestation probably contains some land in which the meadow mice could exist. But, considered as a whole, the Source Areas can be placed in three groups according to the condition of their soils and vegetation, and the resulting meadow mouse environment.

Susceptibility of Source Areas
To
Meadow Mouse Devastation

Very Vulnerable	Moderately Vulnerable	Not Vulnerable
1. Hay Swamp	2. Harpley	3. Pinery
4. Smith Lake	6. Arkona	
5. River Bend	7. McInnis	
11. Ailsa Craig	8. Parkhill	
13. Staffa	9. Bornish	
	10. Keyser	
	12. Clandeboye	

(The Source Areas are shown on the Source Areas Map in the Forestry Section)

(e) An intensive year-round investigation should be made of the habits and life history of Microtus with special attention to winter and early spring feeding habits, and the effects of climate on this type of food, and to predator relations.

(f) Carefully controlled experiments on mouse control should be made, using:

(1) Poisons

(2) Deterrents and Repellents

(3) Biological Control, e.g. by bacteria

(4) Natural Predators - Quantitative studies could be made of the relation of mouse population to predator population at various mouse population levels, including the number of mice taken by individual predators of various species over a certain period of time, and the effect of the density of cover on the prevention of predation.

(g) Investigation should be made of the feeding habits of other species of mice to determine whether or not they may inflict similar damage.

CHAPTER 7

SMITH LAKE

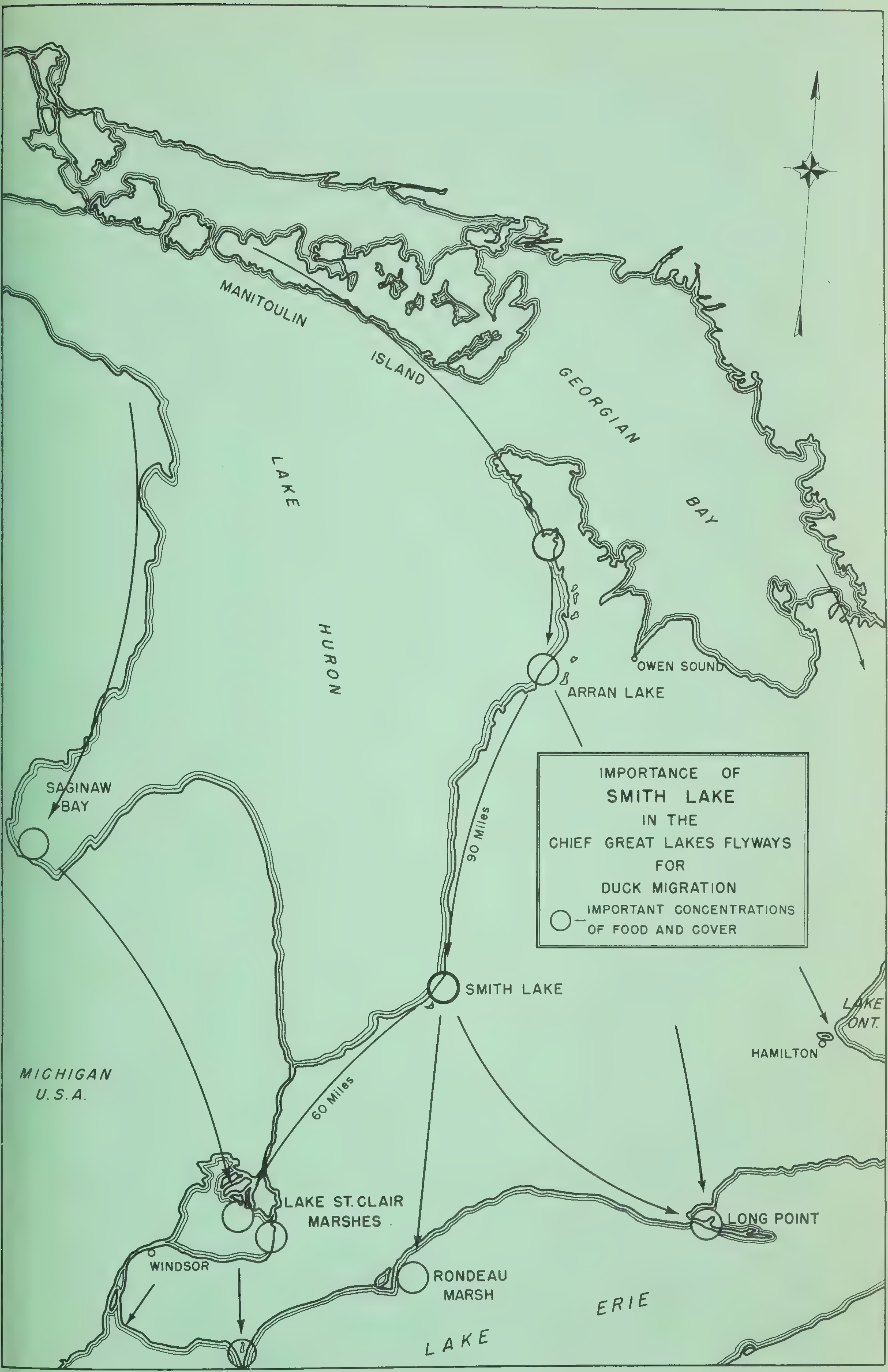
Smith Lake, the remnant of a former extensive lake and marsh area, now includes only 300 acres of open water and 700 acres of floating bog. Its origin, history and subsoil are described in the Land Use section of this report. It lies in an important section of the Great Lakes bird migration flyway and is the only marsh providing excellent cover and food for large numbers of wildfowl in the 150 miles stretching between the Port Elgin-Arran Lake marshes in Bruce County and the Walpole Island and Paincourt marshes on Lake St. Clair. The smaller Port Frank marshlands and the old river course in the Pinery provide alternative nearby cover, and Lake Huron is only a mile away. The importance of Smith Lake is therefore out of all proportion to its area.

1. Wildfowl Population

No exact counts have been made of the wild ducks which bred in the marsh or of those which visited it in migration. The present owner estimates that formerly the lake harboured as many as 5,000-10,000 ducks at one time in migration, and that the number coming in to feed is now often down to 500. The population was reported as reaching "an all-time low" in 1947 Very few bay (or diving) ducks now come in to the lake. The numbers of pond ducks have not shown as great a decrease. Canada geese still visit the marsh in numbers, but less commonly since the "Goose-Marsh" northwest of Smith Lake has been drained, and part of it brought under cultivation.

2. Muskrat Population

No attempt has been made to "manage" the muskrats in the Smith Lake marshes. ~~Since the marshes are closed to the public and the owner does not trap them, the taking of rats is normally carried out by spearing in the winter before the legal season opens, or by placing traps at night and~~


IMPORTANCE OF
SMITH LAKE
IN THE
CHIEF GREAT LAKES FLYWAYS
FOR
DUCK MIGRATION
IMPORTANT CONCENTRATIONS OF FOOD AND COVER
MANITOULIN
ISLAND
GEORGIAN
BAY
LAKE
HURON
OWEN SOUND
ARRAN LAKE
SAGINAW BAY
90 Miles
SMITH LAKE
60 Miles
MICHIGAN U.S.A.
LAKE ONT.
HAMILTON
LAKE ST. CLAIR MARSHES
LONG POINT
WINDSOR
RONDEAU MARSH
ERIE
LAKE

~~removing them before the next morning~~. The annual take of muskrats is estimated by the Department of Lands and Forests to be 400 skins[1] Since Cattails (Typha species) are common throughout the western and southern part of the marsh, the annual yield could, with careful management, be many times the present figure. This is therefore a resource which is not being fully used. The marsh is probably much overtrapped.

Vegetation

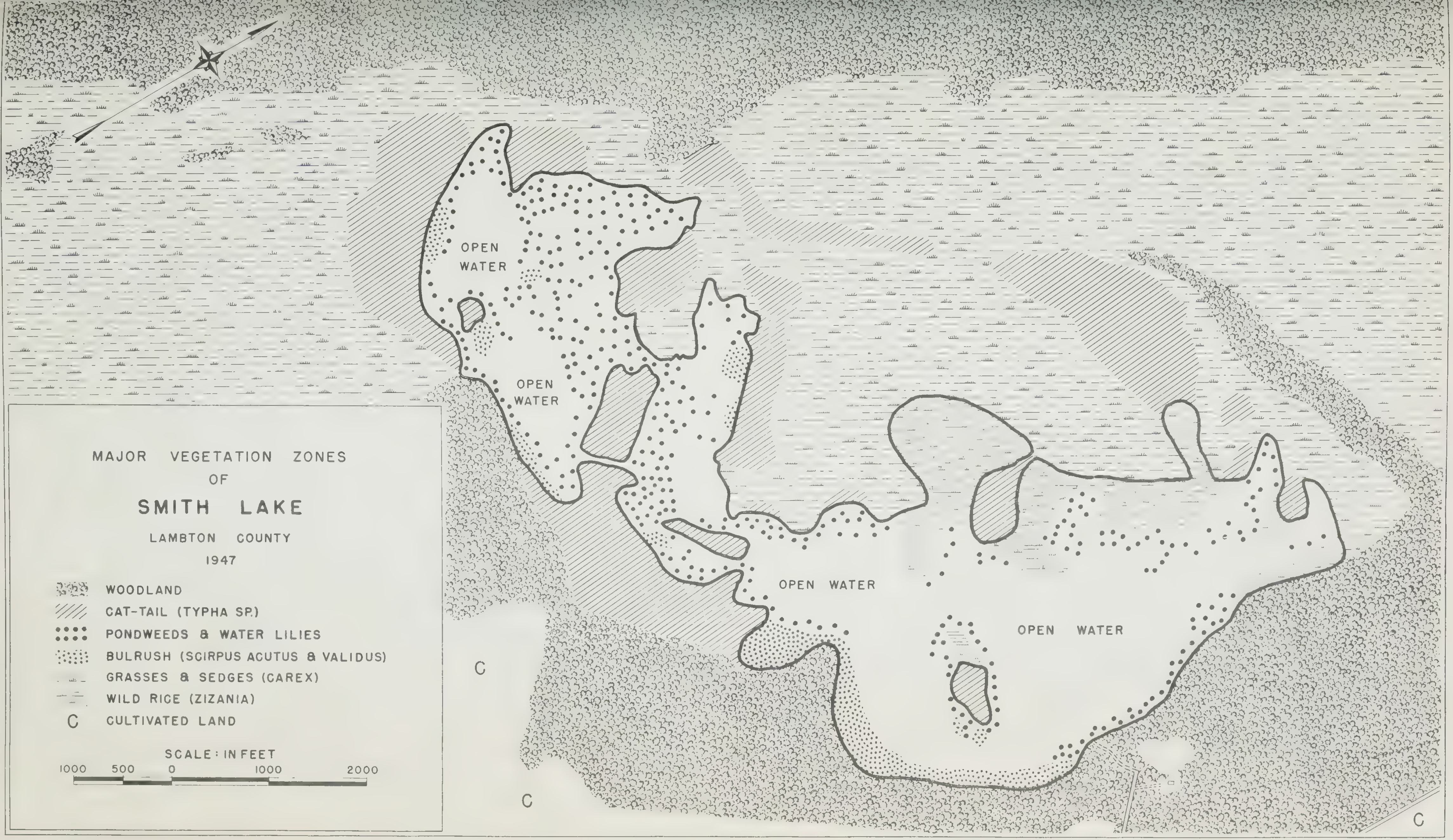
The major zones of vegetation existing in 1947 are shown on the accompanying drawing. The wild rice beds, which are extensive in the northwestern part of the lake, are reported to have spread from introduced seed. A high proportion of the wild rice in the lake in 1947 appeared to be sterile, a condition possibly caused by the great fluctuations in the water levels. This fluctuation may well be also acting as a biological control on the abundance of Cattail (Typha sp.) which, while providing excellent cover, tends to invade the territory of important duck food plants. An attempt has been made to introduce Vallisneria (Wild Celery). This species was found in only one small sector of the lake and is certainly not spreading quickly.

Apart from the growth of wild rice there is no evidence that an important change either in the abundance or nature of the marsh and aquatic vegetation has occurred in the last 10 years. There is certainly no shortage of duck foods. Several of the more valuable pondweeds are common.[2] On the credit side may be listed the great diversity of useful vegetation and cover. On the other hand there is a greater abundance of fair to poor foods, such as Waterlilies (Nymphaea and Nuphar sp.) and Myriophyllum, than is needed. The three

---

1 W.W.H. Gunn, K. Reynolds, R. Braffette, F.S.Cook, B. Shindman, "Advance Report on Wildlife Conditions in Lambton County 1947", Dept. of Lands & Forests, Toronto.

2 Potamogeton pectinatus L.
Potamogeton natans L.


MAJOR VEGETATION ZONES
OF
SMITH LAKE
LAMBTON COUNTY
1947
WOODLAND
CAT-TAIL (TYPHA SP.)
PONDWEEDS & WATER LILIES
BULRUSH (SCIRPUS ACUTUS & VALIDUS)
GRASSES & SEDGES (CAREX)
WILD RICE (ZIZANIA)
C CULTIVATED LAND
SCALE: IN FEET
1000 500 0 1000 2000
OPEN WATER
OPEN WATER
OPEN WATER
OPEN WATER
C
C
C

most valuable bulrushes[1] are restricted to a few sectors. Pickerel weed[2] has taken over some areas. Musk Grass (Chara sp.) occurs but is not common. Duckweeds such as Spirodela polyrhiza (L) Schleid and water shield (Brasenia Schreberi Gmel) are common in some sectors.

Much of the former lake area has been taken over by sedge meadows in which a sedge, Carex lasiocarpa Ehrh., Royal Fern (Osmunda regalis) and two species of Bulrush are dominant. Reed Grass (Phragmites communis Gray) dominates some of the water edge sites, but does not appear to be capable of invading and taking over large areas. The same observation applies to Swamp Loose-strife (Decodon verticillatus (L) ELL.)

Deficiencies

No serious deficiencies were observed in the potential of this marsh to attract waterfowl. The most serious drawback is undoubtedly the wide fluctuation in water levels. It is a debatable point whether this has been increased or not by the construction of the "CUT". The lake would certainly be improved for wildfowl if the Wild Celery (Vallisneria) could be fostered in it, but there are many marshes attractive to wildfowl in which the species does not occur. The marsh appears to provide perfect nesting cover for large numbers of pond ducks, but the number raised annually is low (probably less than 150). This may well be due to the use of a hydroplane for travel on the water areas of the marsh before and during the nesting season.

Present Trends

Shooting is now restricted by the owner. One section of the marsh is said to be set aside as a sanctuary. During the open season the marsh is frequently almost surrounded by trespassers hoping for a shot at a wild duck.

---

1 Scirpus acutus Muhl.
Scirpus validus Vahl.
Scirpus fluviatilis (Torr.) Gray

2 Pontederia cordata L.

In any marsh as important as Smith Lake is to wildfowl the question of private versus public ownership inevitably must be raised. If the marsh were now in public ownership and available to unrestricted shooting during the open season it would certainly be so overshot that eventually few ducks would come into it. At the present time, apart from the effects of disturbance of the marsh in the nesting season, the marsh is being reasonably well managed, i.e. its vegetation and cover are apparently being sustained. It would appear therefore that without strict control of the amount of shooting Smith Lake is of more importance to wildlife under its present ownership than it would be if acquired for the public. The danger of the present situation lies in the fact that while the primary use of the marsh is now for wildlife, there is no certainty under private ownership that the marsh will remain in the hands of those interested in wildlife. Already (in 1947) 480 acres of the "goose marsh" had been bought for development for the cultivation of peppermint. This inevitably entails some type of draining, and is an indication that the inroads on the marsh are continuing.

From the point of view of wildlife management the best hope for the future lies in the fact that the marsh is so strategically placed that it would probably fetch a higher price as a marsh for ducks than if drained and subdivided. The Paincourt artificial marshes for muskrats and ducks in Kent county are probably worth more than the same land was when drained and used for crops. The situation is very similar at Smith Lake. Seasonal flooding affects both areas.

It is recommended that all large and strategically placed wildfowl marshes that are now threatened, as Smith Lake is, should be examined by both Provincial and Dominion wildlife services with a view to safeguarding their future.

CHAPTER 8

FISH

The purpose of this survey was to make a preliminary examination of the waters of the drainage basin and to classify them accurately as to their present suitability for fish, and secondly to make recommendations for possible improvements. The watershed is too large to allow time for a small party to do more than classify the various parts and tributaries in a very general manner. The river could not be visited everywhere but wherever it was visited, detailed work was carried out. Two of the four small lakes which occur in the watershed were examined.

1. Methods

The river and its tributaries were visited at approximately 200 places corresponding generally to the crossing of the river by roads. At each station a form was filled out describing the topographical features of the valley, erosion, aquatic and other vegetation, volume of stream flow, turbidity, temperature, type of bottom and amount of silt deposited. At all stations not dry at the time of visit, collections of the aquatic insects and other invertebrates were made. From more than 70 of the stations collections of fish were made with seines, minnow traps and occasionally gill nets. These collections were examined and classified at a later time.

The aquatic insects were collected because many of the species are reliable indicators of the stream conditions at the critical time of year. Some species are confined to waters which remain cold and clear in summer such as trout waters and others are indicators of warmer water in summer, permanent flow, or polluted water. Thus the potentialities of a stream for particular species of fish are indicated. The fish collections which were of necessity made

STREAM COLLECTION STATIONS

LEGEND

STREAM COLLECTION STATIONS ----------- •

CONTOURS ------------------------ 700

THEDFORD MARSH AREA -----------

SCALE: MILES

1 0 1 2 3 4 5

at fewer stations, have been identified and substantiated these findings at their particular stations.

2. <u>The River Valley</u>

The conditions which determine the kinds of fish inhabiting a river are in part a product of the physiographic conditions of the watershed. These are described in detail in the Physiography section of this report. Only the major features determining the river's course and condition are mentioned here.

There are at present two Ausable Rivers, of which the lesser now consists of former tributaries of the old Ausable, draining the ridges west of the main Ausable upper course. These streams include Sutton Creek, Moray Creek, Haycock Creek and Parkhill Creek, and their water flows into Lake Huron at Grand Bend. The total fall of this river system is only 200 feet as compared with 500 feet for the main Ausable River. The average gradient of Parkhill Creek, down to the old Ausable channel, is 6.8 feet per mile. The other tributaries flowing more directly westward are much steeper, averaging 9 feet of drop per mile. The flow of Parkhill Creek was measured in July 1947 and the average of three estimates was 4.3 cu. ft. per second. All the other creeks in this river system dry up in summer and they are at present of little importance to fish or fishing.

The course of the main Ausable River is chiefly determined by the system of parallel moraines or low northwest-southeast ridges left by the glaciers. Three of these ridges are well marked. While the main streams flow southeast between the ridges, several of the tributaries have cut back by headward erosion through the ridges east of them, and have captured the main stream of the next valley to the east. Today the main streams still flow southeast but successively cut through the moraines in an east-west direction to drain into Lake Huron.

In addition to the ridges, three factors are important in deciding the character of the rivers. The first of these is the presence of a lagoon-like bay of the former Lake Algonquin, which is now reduced to the Thedford and Smith Lake marshes, cut off from Lake Huron by sand dunes. Both river systems therefore pass across a low plain.

The second factor is the character of the soil of the watershed. Both the Thedford marsh and several of the upper river channels gradually became filled by accumulation of organic matter and formed muck soils. There are also a few areas of light sand, but most of the watershed is covered with a heavy clay loam, and this is reflected in the condition of the river in time of flood.

The third factor is the gradient of the streams. A summary of the gradients of a representative series of the streams follows. This information may be found in greater detail in the Hydraulic section of this report.

DRAINAGE TO GRAND BEND

Name of Stream	Stream Section	Gradient
Parkhill Creek	Headwaters to Old Ausable Channel	6.8 ft. per mile

DRAINAGE TO PORT FRANK

Name of Stream	Stream Section	Gradient
Main Ausable River	Headwaters to #83 Highway near Exeter	12 ft. per mi.
Main Ausable River	#83 Highway to Start of "Cut"	3 ft. per mi.
Main Ausable River	Start of "Cut" to Lake Huron	1 ft. per mi.
Hay Swamp Creek	Headwaters to Main Ausable River	3.7 ft. per mi.
Little Ausable River	Headwaters to Main Ausable River	10 ft. per mi.

DRAINAGE TO PORT FRANK (Continued)

Name of Stream	Stream Section	Gradient
Nairn Creek	Headwaters to Main Ausable River	15 ft. per mi.
Arkona Creek	Headwaters to Main Ausable River	37 ft. per mi.
Adelaide Creek	Headwaters to Main Ausable River	7.5 ft. per mi.
Jericho Creek	Headwaters to Main Ausable River	11.2 ft. per mi.

A study of the gradients discloses a significant fact. While all the tributaries flowing westward or northward off the morainic ridges have a good gradient, the main stream below Exeter running parallel to the ridges has a very low gradient. The three feet per mile gradient of the main stream from Exeter to the "Cut" is remarkably uniform, except for a drop of 20 feet in two miles of the Arkona gorge. The Hay Swamp Creek has also very little fall. The "Cut" and the old Ausable Rivers have a very low gradient.

Since the main river has a low gradient and the soil is chiefly clay loam, the bottom is heavily silted, except in a few areas where the river is cutting through a moraine and where it drops rapidly through the Arkona gorge.

3. Permanence of Flow

From the point of view of fish management, two of the most important characteristics of any stream are its permanence of flow and its summer temperature. There are other important characteristics but in the rivers of Southern Ontario these two are often the most critical factors in fish survival. The two characters are combined in the accompanying map titled "Biological Conditions of Streams". This map, based on an intensive study of the fish and invertebrate life of 200 stations scattered throughout the watercourses, shows at a glance two facts. The first is that most of the tributaries are dry or merely a succession of standing pools in

BIOLOGICAL CONDITIONS OF STREAMS

LEGEND

- PERMANENT FLOW COLD
- PERMANENT FLOW COOL IN SUMMER
- PERMANENT FLOW WARM IN SUMMER
- DRIES UP TO STANDING POOLS IN SUMMER
- DRIES UP COMPLETELY IN SUMMER
- STREAMS NOT EXAMINED

SCALE : MILES

1 0 1 2 3 4 5

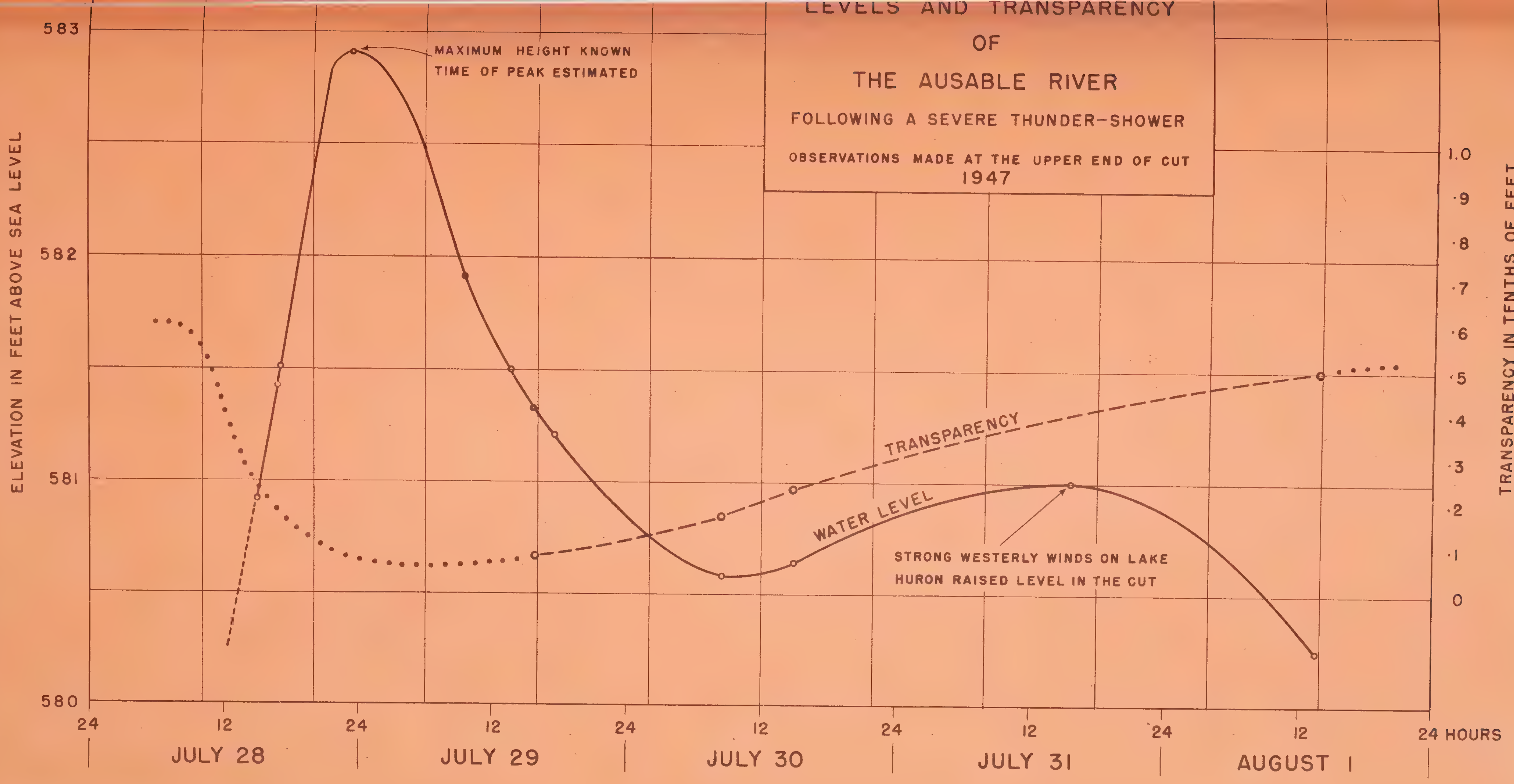
summer. The second is that very little of the water is cool enough to support the finer game fish such as brown trout and speckled trout. The colours on the map give an indication both of the maximum temperature which a stream may reach and of the daily mean (average of maximum and minimum) to be expected. Thus streams in the blue (cold) range have little fluctuation in temperature, with daily mean in the warmest part of the summer not rising above about 63° Fahrenheit. The absolute maximum is not above about 75°. Streams in the green (cool) range have somewhat wider fluctuations, but the daily mean does not rise to more than about 68° and the maximum is probably not above 80°. The streams in the warm (red) range may have a high daily mean of up to 75° and the maximum may rise to near 90°.

It may be seen from the map that cool springs providing possible trout water are found in the following areas:-

1. In the region of Staffa.
2. In the Hay Swamp.
3. Near the mouth of the Little Ausable
4. On Nairn Creek.
5. On three tributaries flowing into the Arkona gorge.

The volume of flow is a vital stream characteristic. This feature is not shown on the map. Stream flows measured at a single visit to a station are open to wide error, but some general conclusions may be drawn.

The headwater springs of the main Ausable in the Staffa region have an excellent flow, further increased near Exeter. The upper part of the Little Ausable supplies little or nothing to the river, being intermittent in dry summers. This section was through an error shown as permanent on the accompanying map. The flow is considerably augmented from springs in the gravel ridge about a mile from its junction with the main stream. Nairn Creek has a good flow of cool water in both branches. The Hay Swamp Creek has a fair


LEVELS AND TRANSPARENCY
OF
THE AUSABLE RIVER
FOLLOWING A SEVERE THUNDER-SHOWER
OBSERVATIONS MADE AT THE UPPER END OF CUT
1947
MAXIMUM HEIGHT KNOWN
TIME OF PEAK ESTIMATED
TRANSPARENCY
WATER LEVEL
STRONG WESTERLY WINDS ON LAKE
HURON RAISED LEVEL IN THE CUT
ELEVATION IN FEET ABOVE SEA LEVEL
583
582
581
580
TRANSPARENCY IN TENTHS OF FEET
1.0
·9
·8
·7
·6
·5
·4
·3
·2
·1
0
24
12
24
12
24
12
24
12
24
12
24 HOURS
JULY 28
JULY 29
JULY 30
JULY 31
AUGUST 1

permanent flow of cold water (estimated at 6 c.f.s. in the summer of 1947) but since it has a muck bottom it can hardly be recommended as a trout stream.

The streams flowing into the gorge from the south have a comparatively negligible flow. The cold stream shown on the map as rising in the northwest corner of Adelaide Township had in 1947 a permanent flow of 1 c.f.s. and would provide enough cool water to supply a two-acre trout pond. Similarly the millstream rising in the northeast corner of Warwick Township would provide water for a six-acre trout pond. The stream flowing down the Arkona Rock Glen had a minimum flow in 1947 of .25 c.f.s. and would provide a half-acre trout pond. The higher reaches of this stream are locally reported to be a good trout stream. The flow of Adelaide Creek was estimated in the summer of 1947 to be 5 c.f.s. but the water was warm and unsuitable for trout. There are also springs in the "Pinery" sand dunes near the site of Brewster's Mill in Bosanquet Township. This stream is too warm for trout.

4. Erosion and Pollution

The extent of sheet and gully erosion in the watershed is described in the Soils section of this report. A great deal of soil still finds its way into the river's tributaries. Since the gradient of the main stream below Exeter is low, the rate of flow is reduced, but the bed and banks are much eroded during floods and much silt is deposited in these slow-flowing sections and the main stream normally carries a heavy load of silt and clay. While there are scattered examples of low intensity pollution at several points, the only large-scale pollution of the river system occurs at Exeter, and at Parkhill on the Parkhill Creek. There is seasonal pollution caused principally by "pea juice" from the canning factory at Exeter. The per cent saturation of oxygen in the two polluted streams was measured by the "Miller" method in the summer of 1947, during the canning season. Results

were as follows:-

Location	Date and Time of Test	Oxygen % Saturation	
		Lowest of 5 Readings	Mean of 5 Readings
Main Ausable below Exeter canning factory	18:viii:47 11 a.m. to 1 p.m.	67	88
Parkhill Creek at Parkhill	4:viii:47 2.30 to 4.30 p.m.	68	80

These figures show that so far as fish life is concerned there was no serious pollution of the streams at the time of observation. At Exeter the quarter-mile ditch carrying the waste was black and foul, but the Ausable itself was little affected, since the dilution factor was high. It is possible that in an exceptionally dry summer the flow from the springs above Exeter might be reduced to the point where the effluent would seriously affect the river's fish potential; but this was certainly not the case in 1947.

5. Fish Distribution

Because of its low flow in dry summers and the drying up of most tributaries, the Ausable in its present condition has little to recommend it as a fishing stream. The low water levels reduce both the cover for fish and fish foods. The coloured stream map shows that the influence of the few remaining cold springs in keeping the river cold in summer is limited in most cases to the upper mile or so of the tributary concerned. The heavy silting resulting from normal spring floods and the occasional summer ones has further reduced the areas for those game fish requiring rocky pools and rapids.

During the survey speckled trout were recorded only in the Denfield branch of the Nairn Creek, which is well suited to the species. Most of the remaining cool tributaries are so small that they would not produce or sustain many trout unless trout ponds were created near their sources.

It is reported that many brown trout were placed

Catfish and pike are the common fish where the river dries to standing pools in the summer. This is the Little Ausable near Clandeboye.

Permanent tributaries from cold springs are not common in the watershed. This is a trout stream above Rock Glen, near Arkona.

The main Ausable River in the Arkona Gorge is rapid and shallow, but provides some shelter for bass.

One of the lagoons south of Port Frank. The chief species here are bluegills and pike.

in Adelaide Creek. The results of the present survey indicate that this creek at least in warm summers is unsuitable for brown trout, but the species might safely be introduced in any of the streams shown on the accompanying map in green or blue.

The bass family is at present represented in the river by the large-mouth bass, small-mouth bass, rock bass and three species of sunfish (the pumpkinseed, bluegill and the long-ear sunfish). Apart from the bluegill, which is common in the old river channel in the "Pinery", fish of the bass family are scarce in the river. Both the large and small-mouth bass are scattered in distribution, occurring at intervals in the main channel from just above Exeter to the river mouth and also in the Little Ausable. The pumpkinseed, long-ear sunfish and rock bass were found sparingly in tributaries of the main river. Rock bass were also taken in Mud Creek above Parkhill.

The northern pike is found in placid weedy reaches of the main river, and some of the tributaries. It is reported to have been more abundant in the past. The maskinonge is reported from the lower canal section, but is scarce.

LIST OF FISHES OF THE AUSABLE WATERSHED

Bowfin	Amia calva Linnaeus
Eastern speckled trout	Salvelinus fontinalis (Mitchill)
Common white sucker *	Catostomus commersonnii (Lacépède)
Hogsucker	Hypentelium nigricans (LeSueur)
Golden redhorse *	Moxostoma erythrurum (Rafinesque)
Creek chub *	Semotilus atromaculatus (Mitchill)
River chub	Nocomis micropogon (Cope)
Blacknose dace	Rhinichthys atratulus (Hermann)
Longnose dace	Rhinichthys cataractae (Valenciennes)
Redbelly dace	Chrosomus eos Cope
Rosyface shiner	Notropis rubellus (Agassiz)
Common shiner	Notropis cornutus (Mitchill)
Spottail minnow	Notropis hudsonius (Clinton)
Blacknose shiner	Notropis heterolepis Eigenmann and Eigenmann
Brassy minnow	Hybognathus hankinsoni Hubbs
Bluntnose minnow *	Hyborhynchus notatus (Rafinesque)
Channel catfish *	Ictalurus lacustris (Walbaum)
Brown bullhead *	Ameiurus nebulosus (LeSueur)
Mud minnow	Umbra limi (Kirtland)

(continued)

List of Fishes of the Ausable Watershed (Continued)

Pike *	Esox lucius Linnaeus
Maskinonge *	Esox masquinongy Mitchill
Yellow perch	Perca flavescens (Mitchill)
Pike-perch, pickerel *	Stizostedion vitreum (Mitchill)
Blackside darter	Hadropterus maculatus (Girard)
Johnny darter	Boleosoma nigrum (Rafinesque)
Rainbow darter	Poecilichthys caeruleus (Storer)
Fan-tail darter	Catonotus flabellaris (Rafinesque)
Least darter	Microperca microperca (Jordan and Gilbert)
Small-mouth bass *	Micropterus dolomieu Lacépède
large-mouth bass *	Huro salmoides (Lacépède)
Pumpkinseed	Lepomis gibbosus (Linnaeus)
Bluegill *	Lepomis macrochirus Rafinesque
Long-ear sunfish	Lepomis megalotis (Rafinesque)
Rock bass *	Ambloplites rupestris (Rafinesque)
Muddler	Cottus bairdii Girard
Brook stickleback	Eucalia inconstans (Kirtland)

---

* Species of particular interest to anglers are starred.

The arrangement follows that of Dymond, J.R., 1947, "A List of the Freshwater Fishes of Canada East of the Rocky Mountains" (Misc. Pub. # 1 - Royal Ontario Museum of Zoology, Toronto).

Pike-perch or yellow pickerel have been extensively stocked in the river. The following table shows all fish distributed in the Ausable and its tributaries since 1930.

Year		Species and Quantity
1932	250,000	Pickerel fry.
1941	1,500,000	Pickerel fry.
1944	1,200	Speckled trout yearlings
1947	2,100	Brown trout fry and yearlings.

Pickerel have apparently supplied surprisingly little fishing, but they have been reported from some sections, particularly the head of the "Cut". Yellow perch have also been reported from this point.

While no real census has ever been made, it appears that the returns of all introduced species have been very low considering the numbers of fish introduced.

Young of the common white sucker were very widely distributed in all parts of the river having permanent flow and in some of the pools temporarily isolated in the drought season. The hog sucker was taken during the survey

at two places on Nairn Creek and probably occurs in other tributaries. The golden redhorse or mullet was recorded from the old channel in the "Pinery" and in the canal section. Many of the suckers are taken by net during the spring spawning migration.

Two species of catfish, the brown bullhead and the channel catfish were taken; the former in the parts of the main river with muddy bottom and in Mud Creek above Parkhill, the latter in the lower part of the main river particularly in the canal region. Here they reach a large size and are sought by anglers.

Bowfins are taken in the old channel in the "Pinery" and in the estuaries. Carp occur in quiet weedy sections of the main river, the old channel through the "Pinery" and the estuaries and adjacent tributaries.

The remaining fish recorded in the river are small species, not of interest to anglers but important as potential food for the larger species. The darters are chiefly restricted to those areas of stony rapids in the permanent sections of the river; e.g., in the main river from above Hensall and Exeter, the Little Ausable, Mud and Nairn Creeks, and the lower parts of Adelaide Creek. The creek shiner and blacknose shiner occurred generally in the streams with permanent flow. Creek chub were more restricted in distribution, but were taken in Nairn Creek, the main river and the small tributaries near Arkona. The longnose and blacknose dace were found to be similarly distributed. Two other small fish species, the mud minnow and the five spined stickleback were sparsely distributed in local quiet weedy streams.

6. Lakes and Farm Fish Ponds

The watershed has remarkably few lakes and ponds. Apart from Smith Lake and the three lagoons lying in the sand hills south of Port Frank, there are no water surfaces larger than three acres and very few smaller ones. The

characteristics of Smith Lake and the largest of the three lagoons were examined in detail.

Smith Lake has 300 acres of water surface and an average depth of three feet. The bottom is muck over sand and the greatest depth is five feet. The bottom temperature when measured was 76°F. The surface temperature rises to at least 86°F. The oxygen per cent saturation, as measured on a warm afternoon, was 64 - 75 per cent. The water in the open lake was slightly alkaline, having a pH of 7.4 - 7.6. The outstanding characteristics of the lake are its shallowness and consequent high bottom temperature and the profusion and variety of both submersed and emergent vegetation. The edges of the lake are chiefly floating bog. Details of the vegetation are given in Chapter 7, headed "Smith Lake", of this report. Carp, bowfin and pike are present along with smaller fish. Bass have been introduced but have not persisted, probably owing to winter kill.

The largest of the three lagoons in the dunes south of Port Frank was examined. All three are surrounded by high sand hills and appeared to have similar characteristics. They were formerly part of the outlet of the Ausable River. The lagoon examined extends over eleven acres with average depth of four feet and maximum depth of twelve feet. The surface and minimum bottom temperatures when recorded in August 1947 were 81°F. and 65°F., but most of the pond is shallow with bottom temperature 75° - 76°F. The bottom is muck and detritus over sand. The chief shore vegetation includes sedge meadows and bulrush (Scirpus acutus). The aquatics which are common and well distributed include Pondweeds, Water-lilies and Bladderwort. Cattails are scarce.

Fish species reported to be in the lagoon in 1947 included sunfish, bluegills and pike. The last named species was collected by the survey party.

Farm ponds are almost entirely lacking in the watershed. The ones examined were those at Exeter and at

Denfield. Neither covers more than three acres or is more than six feet deep. Exeter Pond is warm in summer (minimum temperature in warm weather at or near 75°F.) and has very dense aquatic vegetation, chiefly Coontail, Pondweeds and smartweeds (Polygonum). The dam creating this pond is kept up because the pond is used for water storage for fire protection purposes.

Denfield Pond is cool with a bottom temperature as recorded on a warm August day in 1947, of 65°. Dense stands of Cattail surround one side of the pond. This pond is tending to silt up but still provides a suitable habitat for speckled trout which are maintained by restocking.

Farm Fish Ponds:

The chief research on management of farm fish ponds has been carried on in southern and warmer climates and therefore the findings cannot be applied without qualification to an area having the climate of Southern Ontario, but some definite recommendations may be made. Farm ponds are of two kinds[1]. The first is the cool pond with abundant oxygen supply from continuous inflowing water and maximum temperature below 75° (Fahrenheit). This type of pond is best adapted to the production of speckled trout or brown trout. These species of trout do not reproduce in ponds and must be maintained by periodic restocking. Ponds cold enough for trout should be stocked only with trout and the two species of trout should not be mixed. Speckled trout fingerlings should be stocked at the rate of about 300 per acre.

The second and commoner type of farm pond is the warm water pond. Most farms have at least one low spot suitable for a fish pond. It is frequently good practice

---

[1] An excellent handbook on the details of construction and management of farm fish ponds is "Fish Ponds for the Farm" by F.C. Edminster, published by Charles Scribners Sons, New York, 1947. Some of the above information is abstracted from this bulletin.

to have separate ponds devoted to wildlife and fish and to control the aquatic plants in the fish pond. In general the treatment of farm fish ponds involves the following improvements:

(a) A dam should be built with a 3-1 slope upstream and a 2-1 slope downstream ensuring a minimum depth of 10 feet over at least 25% of the pond, to avoid excessive winter kill, probably the critical factor in fish survival in most farm ponds in Ontario.

(b) An emergency spillway should be provided.

(c) If suckers, carp or large numbers of minnows are already present in the pond, it is usually best to destroy all fish in the pond.

(d) It is often necessary to control existing aquatic plants by raking or handpulling.

(e) There have been few tests made in Ontario of the efficiency of applications of fertilizer in increasing the crop of plankton, the smaller aquatic invertebrates. The research now being carried out in this field may lead to application of fertilizers such as 8-8-4 becoming more general.

(f) Stocking of fish is necessary in most ponds. Warm water ponds may be stocked to the best advantage, after destroying the previous fish, with a combination of large-mouth bass (Huro salmoides) and bluegills (Lepomis machrochirus) at the rate of 100 bass per acre and 1000 bluegills per acre. Fishing must be deferred until some of each species have spawned successfully.

(g) The foregoing recommendations concerning warm water farm ponds are based only on the experience of United States wildlife specialists. No results are available from planned experiments in farm pond management in Ontario. There is urgent need for research work in this field.

After carefully considering the possibilities, the farmer who is interested in fish ponds should consult

the local Fish and Wildlife Biologist, of the Provincial Department of Lands and Forests. The overseers and biologists can suggest profitable alterations or additions to any plans made.

7. Summary

Most of the Ausable River now provides very little fishing. Its chief deficiencies are the tendency of most of the streams to rise to severe floods and to dry up in summer. Much of the river also carries almost continuously a heavy load of silt and colloidal clay. There is a serious lack of shade and sheltering logs and pools for fish, and the temperature of most of the permanent tributaries is unsatisfactory for the most highly prized game fish, the speckled trout; but the river can be greatly improved if the following steps are taken.

Nine small tributaries still have cold spring water at their sources throughout the year. These tributaries should be protected and improved by further planting of trees (chiefly cedar or alder) around the sources and along the banks. Individual owners of most of the streams could improve them for trout by constructing ponds near the sources. These ponds should be confined at present to the sections of the tributaries coloured blue on the map. Their sequence in any tributary should be carefully planned having regard to the type of outflow and the amount of spawning water remaining. Every possible encouragement should likewise be given to farmers to construct and maintain warm-water farm ponds, since these not only help to prevent floods and raise the ground water level in summer, but also can provide a sustained annual yield of pan fish.

If the Hay Swamp dam proposed in the Hydraulics section of this report were constructed, the reservoir would increase the sections of the river now available to bass. The building of small dams and deflectors in the river below the

reservoir would create more cover, in the form of deeper pools, for the larger fish. The reservoir itself would fluctuate in level too much to make it of any great value for fish.

It is recommended that the introduction of fish into the watershed should be restricted to those parts of the river which are shown by the survey to be suitable habitat for the species concerned.

So far as the warmer sections of the Ausable are concerned, it should be noted that many useful species such as large and small-mouth bass, bluegill and sunfish, already occur in the river but not in sufficient numbers to provide much fishing. In the Ausable, introduction of fish is of less importance than improvement of the river.

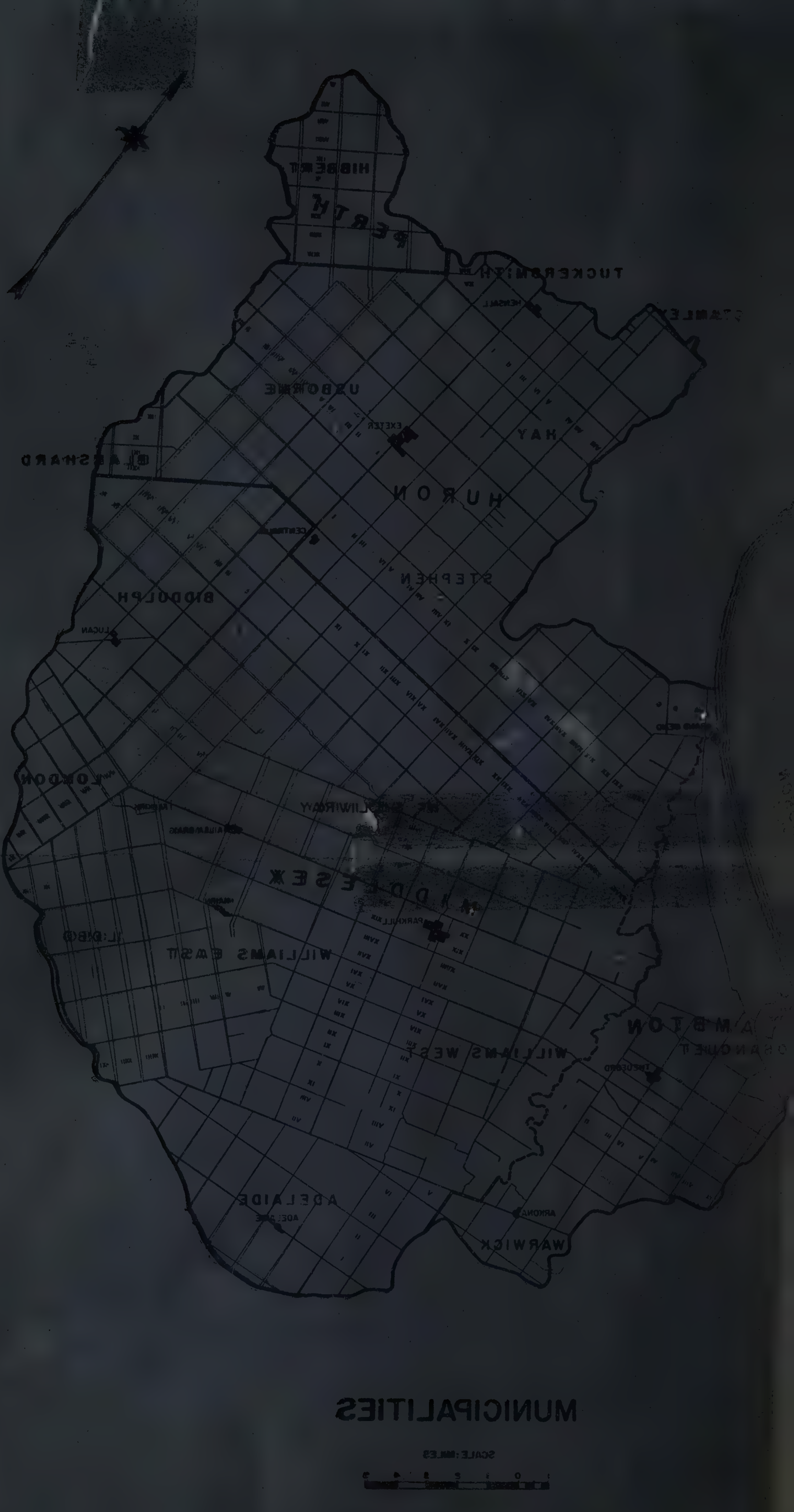
The idea of management of such "panfish" as bluegill and sunfish is repugnant to most game supervisors and to many of the public. Since many streams and ponds in agricultural Southern Ontario now produce little or nothing and cannot be expected even with advanced land conservation measures, to produce the finer species of game fish, it seems a reasonable policy to make such waters yield a valuable return of other species more suited to the changed environment. At the same time the long term end should also be kept in view of increasing the sections of the river suitable to speckled and brown trout.

RECREATION

MUNICIPALITIES

SCALE: MILES

1 0 1 2 3 4 5


HIBBERT
PERTH
TUCKERSMITH
HENSALL
USBORNE
EXETER
HAY
BLANSHARD
HURON
STEPHEN
BIDDULPH
LUCAN
LONDON
MIDDLESEX
PARKHILL
LOBO
WILLIAMS EAST
WILLIAMS WEST
ADELAIDE
ARKONA
WARWICK
MUNICIPALITIES
SCALE: MILES

RECREATION

RECREATION

CHAPTER I

RECREATION

1. General Considerations:-

There are two good reasons for including recommendations concerning recreation facilities in this report. Catering to those interested in recreation is already one of the most important occupations in the Ausable Watershed. The capital invested in it is very great and every sign indicates a rapid future growth. It is, therefore, in the interests of a great many residents of the watershed that the facilities on the Lake Huron shore should be wisely developed.

The second reason is concerned specifically with the recreation needs of those living in the watershed. In the past, the planning of recreational facilities in Ontario has been chiefly directed towards two ends: facilities such as parks and playgrounds within the boundaries of cities and towns, and facilities for long and comparatively expensive vacations in wilderness regions far from the agricultural and industrial areas of the province. The time and cost involved in reaching wilderness areas have prevented the average family, or group, from visiting such areas more than once or twice a year. A third type of facility, which has long been neglected is the public area within a drive of one or two hours from the agricultural or urban worker's home.

This report, therefore, has two objectives:

1. To recommend the improvement of existing public recreation areas.

2. To recommend the acquisition or control of areas which are needed for public use, but which are threatened by private interests.

Three points have been kept in view:

1. The retaining and protection of natural advantages.

2. The development of adequate facilities in maximum variety available to all people, no matter what their age, occupation or income may be.

3. The adjustment of recreational plans to any other conservation measures which may be recommended to the Ausable Watershed Conservation Authority.

2. Types of Recreational Facilities:-

The types of recreational facilities commonly considered are as follows:

1. Beaches for swimmers.
2. Beaches for small children.
3. Boating areas.
4. Fishing areas and public wharfs.
5. Group and individual picnic sites.
6. Group and individual camping areas, including trailer parks.
7. Scenic drives.
8. Trails for hiking and nature study.
9. Winter sports areas.
10. Public hunting areas.
11. Arboretums[1].
12. Youth Hostels[2].
13. Historic sites, properly described.
14. Swimming holes.

Some of these facilities require more than the mere acquisition of the land. For example, the operation of public swimming areas may require supervision and control of pollution. Similarly, historic sites may require the erection of markers or cairns. Many of these facilities may be combined in one "Multiple Use Area". They may also be integrated in a broader plan for the zoning of land for health and recreation.

---

1. An arboretum is a collection of living trees, including as many native tree species of the region as possible. Interesting exotic species are sometimes added.

2. The Canadian Youth Hostels Association is part of an international non-profit organization. It organizes clean, well supervised sleeping quarters away from urban areas which are available for a small fee, so that hikers, cyclists and skiers may enjoy the open country "under their own steam" and meet others of similar tastes in attractive and wholesome surroundings. There is an Advisory Council composed of men and women prominent in education. This organization does not cater to those who travel by car.

Two modern and advanced methods of zoning land for recreation are now in frequent use. The first is the setting up of "Green Belts"[1], areas which surround large urban districts, and which are set apart and restricted to agriculture, forestry and recreation. There is no urban growth in the Ausable Watershed requiring this type of plan in the near future. The second method of zoning land for recreation is the selection of any beach or park area of great potential value for recreation and the control of its development. The purpose here is not the restriction of private enterprise - it is the simultaneous development of publicly owned attractive beaches or parks, and privately owned cottage sites, so that neither the interests of the public nor the encouragement of real estate growth is neglected.

Possibilities for most of the facilities in the foregoing list are already found in the watershed, many indicated are now well developed, others could be added with little additional planning. The main purpose of this part of the report however is to indicate those needy facilities which should be the immediate concern of the Authority.

3. <u>Possibilities for Recreation on the Ausable</u>:-

From the point of view of recreation facilities, there are four main types of land in the Ausable Watershed. These are:-

1. The Thedford Marsh Area.
2. The Ausable Gorge.
3. The Lake Huron Beach, including the "Pinery".
4. The Upland Farming Area.

Most of the Thedford Marsh area is of no importance in recreation planning. It does, however, include

---

1. Many cities in Europe and the United States have long since established "Green Belts". The Green Belt Act became law in England in 1938.

Smith Lake, a privately owned wildfowl marsh, having a great variety of interesting birds and plants, many of them not commonly found in Southern Ontario.

The Ausable Gorge includes about twelve miles of the river valley in the parts of the river north and east of Arkona. The rock formations near the bottom of the valley contain many rare fossils, and for this reason, the Ausable Gorge is known throughout North America. Much of the valley floor is park-like and most of the gorge is almost ideal for parks and picnic sites.

The Lake Huron shore and the "Pinery" provide a magnificent sand beach fourteen miles long, and an attractive area of woodland and the lagoons of the old Ausable. This is destined to be one of the more important recreation areas in Southern Ontario, if it is carefully developed and if its natural advantages are maintained.

The upland farming land, which includes about 90 per cent of the whole area of the watershed, is chiefly rolling land with many shallow valleys and mostly intermittent streams. The scenery is attractive, but not to be compared with that along the Lake Huron shore in the "Pinery". The chief value of this part of the watershed for recreation lies in the suitability of small areas for picnic sites, hiking, fishing, hunting, camping and winter sports.

Apart from Lake Huron, Smith Lake and the lagoons near Port Franks, there are no lakes in the watershed and remarkably few farm ponds suitable for swimming.

4. The Population Factor:-

Ordinarily recreation planning requires a careful estimate of the existing and expected population in the area concerned. On the Ausable Watershed such an estimate is difficult to make. The winter population of the watershed has been estimated at 15,600. This population is remarkably evenly distributed throughout the watershed apart from the

sparsely settled "Pinery" area and the denser areas including Exeter and three smaller centres. The distribution is shown on the Population map in the Land Settlement section of this Report. The winter population is of relatively minor importance in recreation planning for two reasons: The first is that the need of public recreation areas for the people of the watershed, while important, is not the only requirement, since so much annual revenue comes to the watershed from the sale of goods, services and real estate to outside visitors. The second is that the summer population, at least, is rapidly growing. Since three of the four main highways in the watershed, Provincial Highways No. 21, 81 and 82, funnel naturally to the Grand Bend - Port Franks shore, any improvement of the recreation area may be expected to increase business in the towns and villages surrounding this area.

Visitors come into the watershed for recreation from a very wide region. The distance to Port Franks (for example) from London is 41 miles; from Detroit, 96 miles; and from Toronto, 159 miles. A survey[1] of the point of origin of 766 visitors to two hotels in Grand Bend showed that 46 per cent came from the United States, chiefly from Detroit, The origins were as follows:-

Detroit, Michigan	28%
Michigan State (other than Detroit)	14%
Toronto	11%
London	11%
Windsor	9%
Miscellaneous	27%
TOTAL	100%

1. N.L. Nicholson "A Geographic Study of the Watershed of the Ausable River in Ontario", M.A. Thesis, Western University, 1947, unpublished.

These figures probably exaggerate the use of the Ausable for recreation by Americans. The ownership of property in the Grand Bend - Beach o' Pines - Port Franks recreation area is predominantly Canadian. The 1947 assessment rolls showed American ownership of property assessed at $82,000.00, or only 13 per cent of the total assessment of $633,000.00 for the area.

From Ipperwash Park to the north end of Grand Bend, 7,000 persons were estimated to be using the sand beach on a fine Saturday afternoon in the summer of 1947. More than 4,000 of these were on the Grand Bend beach.

The use of these Lake Huron beaches has grown very rapidly in the last three years. The use of the watershed for recreation may be expected also to grow rapidly in the future.

Any facilities planned for the present population may be expected to require extension rather than curtailing for the anticipated increased population. Whatever is planned now should be an integral part of a plan of regional scope. For this reason, it is considered good planning to acquire lands somewhat larger than necessary for the immediate needs, but to develop the recreation facilities within them intensively only as the need arises. The most urgent need in beach development, both on this continent and also in Europe has always been the necessity of acquiring a small proportion of the attractive land for the use of the public before private interests have acquired and built up the entire shoreline, raising the cost to a prohibitive figure. It is not too late to do this on the Ausable Watershed.

CHAPTER 2

PRESENT FACILITIES

In listing facilities for recreation, two distinctions may be made: The first is the separation of undeveloped facilities from those developed. Thus a beach with sand dunes and lake, but with no access by car, no drinking water and no shade is undeveloped. One with shade trees, a road, a pure water supply, some toilet facilities and some facility for buying refreshments is improved. There are many who will use the first type, but more who prefer the second.

The other distinction is that between private and public property. Even a welfare camp such as a Scout Camp must be considered as private, since only those who are members can use its facilities. The chief danger of private property must again be stressed - that, at any time, it may be sold or forever closed to the public.

By statute[1] the "beds" of the Great Lakes in Ontario are now controlled by the Provincial Government up to ordinary "high water mark" and this may be finally fixed by the Minister of Lands and Forests in disputed cases. Thus on lands with very flat shores and in times of low water there may be a wide strip of publicly owned beach. Some owners tend to ignore the right of the public in the "foreshore", as has occurred recently in the "Pinery". The public has the same right to use the "foreshore" as it has to use any other public property such as a road allowance, provided it behaves decently and respects local by-laws. On the other hand, the right to use the foreshore gives no right of access to it, and to enter on private property above high water mark is trespass.

The Lake Huron shoreline in Bosanquet Township has undergone many shifts, through wind and water action. Fortunately, there is a survey showing the established high water mark. This is shown in great detail on the plan prepared

---

1. "Statute Law Amendment Act, 1940" Section 3. The Amendment defines "bed" and "high water mark".

from the survey of R.W. Code, dated August 2nd, 1935, "Plan of the Shore Survey in front of the Township of Bosanquet".

1. Grand Bend:-

In 1947 the Village of Grand Bend included the following numbers and types of houses:

Permanent residences (winter and summer)	52
Summer homes	519
Rented cabins	150
Boarding houses	2
Hotels	2

The village was a former fishing port, and already had a few summer visitors in the 1890's. It first came to priminence as a resort between 1910 and 1920. It had no access by railroad, and grew rapidly as travel by car increased. Its summer population now exceeds 4,000. It provides only one important public recreation facility - an exceptionally fine sand beach. It has extensive commercially developed attractions such as facilities for dancing, roller skating and many other diversions. The beach and the north bank of the old Ausable River are lined with many attractive summer homes. The foregoing table shows that while the village has grown up as a centre for the vacationer who has a week or more to live in the vicinity, it has not been developed for the casual visitor. There is little evidence of planning in its lay-out. For instance, the main facilities for children are the hot-dog and ice-cream stands and the merry-go-rounds. No public play ground is available other than the fine beach and a softball diamond. While 5,000 persons may line the beach at Grand Bend, there are no public picnic tables or shade trees and no public lavatories. There is a serious car-parking problem on busy days. The haphazard development of Grand Bend results partly from the fact that it is not an incorporated village, including as it does parts of the two counties of Lambton and Huron.

At present many of the rural residents of the watershed appear to prefer the quieter beaches, which are

Turnbull's Grove is typical of the kind of beach facility preferred by many year-round residents of the watershed. Shade, picnic tables, a refreshment booth, fine sand and Lake Huron; these are the requirements.

A scene in the Ausable Gorge Park, which is recommended for acquisition in this report.

The waterway of the old Ausable in the "Pinery" is a naturalist's paradise.

owned privately but open to the public, where adequate shade, picnic tables, seats and refreshments are close at hand. But in spite of any apparent disadvantages to the contrary, Grand Bend is growing in popularity.

2. Port Franks:-

Port Franks, at the mouth of the Ausable, has a permanent (winter) population of about 60 persons. Many others stay from May to November. There are 92 cottage units, 70 in Port Franks and 22 south of Mud Creek. Most of these are used for summer residences by their owners, but 23 are leased or rented by eight individual owners. There is also one hotel of some historic interest, one store and one camp for 75 boys and girls.

The mouths of the Ausable River and Mud Creek provide attractive scenery. The lagoons behind the sand dunes south of Port Franks are not only warm for swimming when Lake Huron is too cold or too rough, but they also are of much interest to naturalists. Around them many plants and trees of more southern distribution may be found. The tulip tree, flowering dogwood and uncommon oaks are present.

Almost all of the land in the Village of Port Franks is now privately owned. Although boating, fishing and riding are available at Port Franks, the chief recreation facility of the area is the Lake Huron beach.

3. Lake Huron Beach and the "Pinery":-

The shore of Lake Huron includes fourteen miles of beach within the official boundary of the Ausable Watershed. Most of this beach is of fine, clean sand and the water is safe for bathing.

At Grand Bend and Port Franks there are wide zones of sand beach, but between these points the beach is narrower with steep sand dunes topped by woodlands of red cedar and mixed oak and pine. The R.W. Code survey of 1935 showed the public part of the beach to have an average width

of 2.3 chains, or 277 feet. While the beach is often less wide than this in summer depending on the water level of Lake Huron there is no doubt that there is a substantial strip which is open to the public. There is however, no access to it by car, and the beach must be classed as an undeveloped facility. Almost all of the shore lots are privately owned. Ownership and developments in this area south of Grand Bend include the following:-

(a) The Canada Company, which formerly owned almost all of the "Pinery", still owns a large block of forested land, including nearly five miles of shoreline.

(b) A private development fronts approximately three-quarters of a mile of shore and here 65 summer homes have been constructed.

(c) South of Port Franks a few small shore lots have been built on.

(d) Ipperwash Camp:-

Ipperwash Military Camp, consisting of 268 acres administered by the Department of National Defence, includes one of the attractive lagoons behind the sand dunes. It also includes nearly a mile of shoreline. An old road, now disused and impassable, leads to the lagoon from Highway No. 21.

(e) Stoney Point:-

The story of Stoney Point is given in the Historical section of this Report. The reef of limestone and chert from which arrow-heads and other useful tools were chipped by the Indians is of great historic interest. "Specimens of Stoney Point chert have been found from Western New York to Michigan[1]".

(f) Ipperwash Provincial Park:-

This park, which adjoins Stoney Point, is just

---

1. W. Sherwood Fox, "T'Ain't Runnin' No More", London, Canada, 1946.

outside the watershed boundary. It is recorded here because its intensive use well shows the great need for publicly owned recreation areas. The park includes 109 acres of woodland and beach. In 1947 on August 29, a typical fine Sunday, 235 cars, 26 trailers and 28 tents were concentrated in the developed area of the park (10 acres). Every available space in the cleared part of the park was in use.

This park, the Port Franks beach and the Grand Bend beach are the three focal points of population used in the shoreline from Ipperwash to Grand Bend. The beach from Stoney Point to Port Franks is used by from 150 to 250 cars at a time on fine week-ends. There is a satisfactory width of public beach varying (on the R.W. Code survey plan of 1935) from 145 to 275 feet in width. At times, the beach is difficult to drive over and near Port Franks in 1947 it was often impassable. The shifting sands vary and might any year leave the beach without access by car. The subdivision of the shore lots, which is already under way, could therefore easily leave the public excluded from the beach.

(g) Lambton County Forest:-

This is a forest of 630 acres, of pine planted amongst existing oaks. It has no beach frontage. It has, however, possibilities as a woodland park, but its fire hazard is very high in dry weather.

(h) The "Pinery":-

The composition and importance of the "Pinery" are described in the Forestry section of this Report. Apart from the Lambton County Forest, it is entirely privately owned. The many unusual plants, the southern type of forest, the beautiful winding river and lake and the historic old tote road and mill site make the "Pinery" an area worth retaining with a minimum of alteration, even if it did not also contain one of the finest beaches on Lake Huron. When this facility is added, it is easy to see why so many people are

interested in the preservation of this unique area. No comparable piece of natural parkland can be found in Southern Ontario. As described in the Wildlife section of this Report, many interesting species such as the Bald Eagle spend the summer in the "Pinery". It has, however, two drawbacks, both of them controllable. The first is the large numbers of biting insects of the genus Tabanus, which are a serious disadvantage in the month of July. These could be controlled in any heavily used park area by the methods now in use at Rondeau Park. The second drawback is poison ivy, which is abundant throughout the area. Local control of poison ivy can be easily achieved with a liquid spray of ammonium sulphate, sodium chlorate and water. This mixture must be handled by experienced men, as improper mixing or use may result in fires.

4. Smith Lake:-

A description of this fine wildfowl marsh may be found in the Wildlife section of this Report. As a recreation facility, it appeals only to gunners and naturalists. This marsh is the last stand in this part of Ontario for a remnant of rare and beautiful marsh plants, including several species of orchid. The importance of the marsh to wildfowl is shown on a drawing of Southern Ontario in the Wildlife report. Under its present ownership, it is probably of more use to wildfowl than it would be if opened indiscriminately to the public. For this reason, its immediate acquisition is not recommended, but some attempt should be made to safeguard its future.

5. Facilities on No. 21 Highway:-

The facilities developed along the Blue Water Highway within the watershed (exclusive of those in Grand Bend) included the following in 1948:

Four tourist cabin groups, two additional groups with picnic grounds, one camping ground and one road-

side table all privately owned.

The location of the above facilities is shown on the accompanying map. All of them were examined in detail during the course of the survey. While there were exceptions, the usual tendency in the development of this type of tourist accommodation in this area appeared to be that three stages took place, as follows:

First a lunch counter and soft drink stand is built; later, groceries, vegetables and gasoline are sold; and finally, simple cabins and in some cases road-side picnic tables and benches are added.

There appeared to be very few examples of a careful plan of building or expansion. There is little doubt that several of the tourist cabin operators on No. 21 Highway lose business repeatedly because of failure to keep the front, at least, of the property both clean and tidy.

In addition, the Department of Highways of the province has established an excellent road-side picnic site at the junction of Highways No. 21 and 82. This is a triangular area of one acre with fine shade trees. Tables are provided.

A second road-side picnic site, with tables provided, was noted on No. 21 Highway in the "Pinery". The buildings on this property have been recently burned down, but the picnic tables were still in place in 1948.

6. Camping Grounds:-

Camping grounds in the area include three Boy Scout Camps namely: that of Sarnia, west of No. 21 Highway on the south bank of the Port Franks' "Cut" - an attractive piece of woodland with high hills overlooking the river; another in the Canada Company's Land in the "Pinery", about two miles from No. 21 Highway; and the third close to the Arkona mill dam. All are attractive and well cared for properties.

7. Airport:-

The R.C.A.F. auxiliary landing ground just east of Grand Bend must be listed as an unusual recreation facility. This area is used with permission by summer visitors. Flying Clubs occasionally meet and spend a week-end at Grand Bend, making use of the airport.

8. Golf Course:-

There is one private golf course with restricted membership operated at Grand Bend on the edge of the watershed.

9. Small Parks:-

While there are several small parks within the boundaries of towns and villages in the watershed, only one was noted as a particularly attractive site. This was Exeter Park on the east side of the bridge over the Ausable at Exeter. The reservoir created by a dam is used for water storage for emergency use in case of fire, and there is an attractive pool, still used for swimming although the pond is tending to silt up and to be filled with aquatic vegetation. The park includes about four acres of land, with some shade trees. A fire-place with picnic tables and incinerator and drinking water is provided.

Although the pond could be improved by dredging, and the picnic tables and incinerator could be of better design, this park was one of few instances noted in the watershed where a fine natural site had been acquired and improved for the public. Most towns and villages have such sites, but very few acquire them for the public.

10. The Arkona Gorge:-

The spectacular gorge of the Ausable, near Arkona, is a popular spot for picnics and sightseeing. The picturesque rock glen and falls are visited by many thousands of people every year. This part of the river is open to the public only through the courtesy of the property owner. At

any time it might be closed to the public. The exposed bedrock of blue shales and grey limestone in the gorge has attracted geologists and collectors from many parts of North America because of the abundance of fossils of primitive plants and animals. One species of mollusc is rare enough to have been given the name "arkonensis" in honour of the Village of Arkona.

Although this area is neither developed for public use nor in public ownership, it is second only to the Lake Huron beach as an attraction to the public. Part of the bottom land near Arkona is park-like with rich pastures and fine shade trees. Most of the slopes of the gorge are wooded.

11. <u>Swimming Holes</u>:-

No list was made of the existing and potential swimming holes on the Ausable River. Several were noted but it was assumed enough might have been overlooked to make the list invalid.

12. <u>Historic Sites</u>:-

There is an Indian burial-ground one mile east and three quarters of a mile north of Stoney Point. This should be protected. It is not of great importance, as it is of comparatively recent origin.

13. <u>Recapitulation</u>:-

From the foregoing catalogue of facilities in the watershed, the present recreational use of the area can be summarized.

The watershed has a thriving summer colony. Only one other area in Southwestern Ontario can be compared with the Ausable "Pinery" and shore as a natural recreation area; that is, Rondeau Park. The comparison is of importance because at Rondeau Park large areas have already been set aside as public beaches and even in the areas divided for cottage sites, every tenth lot has been kept vacant to allow public access to the beach. There is no such planning on the

Ausable Huron shore. The outstanding characteristic of the shore from Stoney Point to Grand Bend is the complete lack of publicly owned shore lots.

The Blue Water Highway in the watershed presents a similar picture of a resource which would benefit from some measure of zoning or controlled development. If no planning for the future is carried out, it may be expected that the woods will sooner or later be sold in small lots. The natural beauty of the "Pinery" will be lost if many of the lots on No. 21 Highway are built up.

The Arkona Gorge is a natural land form which combines attractive scenery and many suitable picnic sites. It is also of great educational value. The whole area is private property.

The remainder of the watershed is now little used for recreation away from home, apart from parks within the boundaries of towns and villages. This results partly from the proximity of Lake Huron to the watershed, and partly from the fact that most of those who live in the watershed are engaged in agricultural work and are less often interested in outdoor recreation of the types mentioned in this Report. Nevertheless a surprising number of those farmers with whom the subject was discussed indicated an interest in the retaining of a few attractive parks and picnic sites in the agricultural land of the watershed. Many also indicated an interest in hunting. Game species are very scarce in the watershed, and those who hunt species other than the jack-rabbit and cottontail generally spend one or two weeks every year in the forested lands of the Bruce Peninsula or farther north.

RECREATION
LEGEND
EXISTING FACILITIES
PRIVATELY OWNED
PUBLICLY OWNED
PROPOSED FACILITIES
"PINERY" AREA RECOMMENDED FOR CONTROL (SEE DETAILED DRAWING)
SMALLER PARKS AND PICNIC SITES RECOMMENDED FOR DEVELOPMENT
SYMBOLS
TOURIST CABINS
PICNIC SITES
CAMPING SITES
SCALE MILES
LAKE HURON
GRAND BEND
BEACH O' PINES
PORT FRANKS
WILDLIFE AREA
THEDFORD
PARKHILL
AILSA CRAIG
NAIRN
AUSABLE GORGE PARK
ARKONA
EXETER
CREDITON
CENTRALIA
CLANDEBOYE
LUCAN
STAFFA
CROMARTY
KEY
RECOMMENDED PICNIC SITES
3 MAPLE GROVE PARK
THEDFORD PARK
EXISTING
COMMERCIAL TOURIST CABINS
8 TO 15
BOY SCOUT CAMPS
16 AND 17
FACILITIES AT PORT FRANKS AND GRAND BEND ARE NOT INCLUDED)

CHAPTER 3

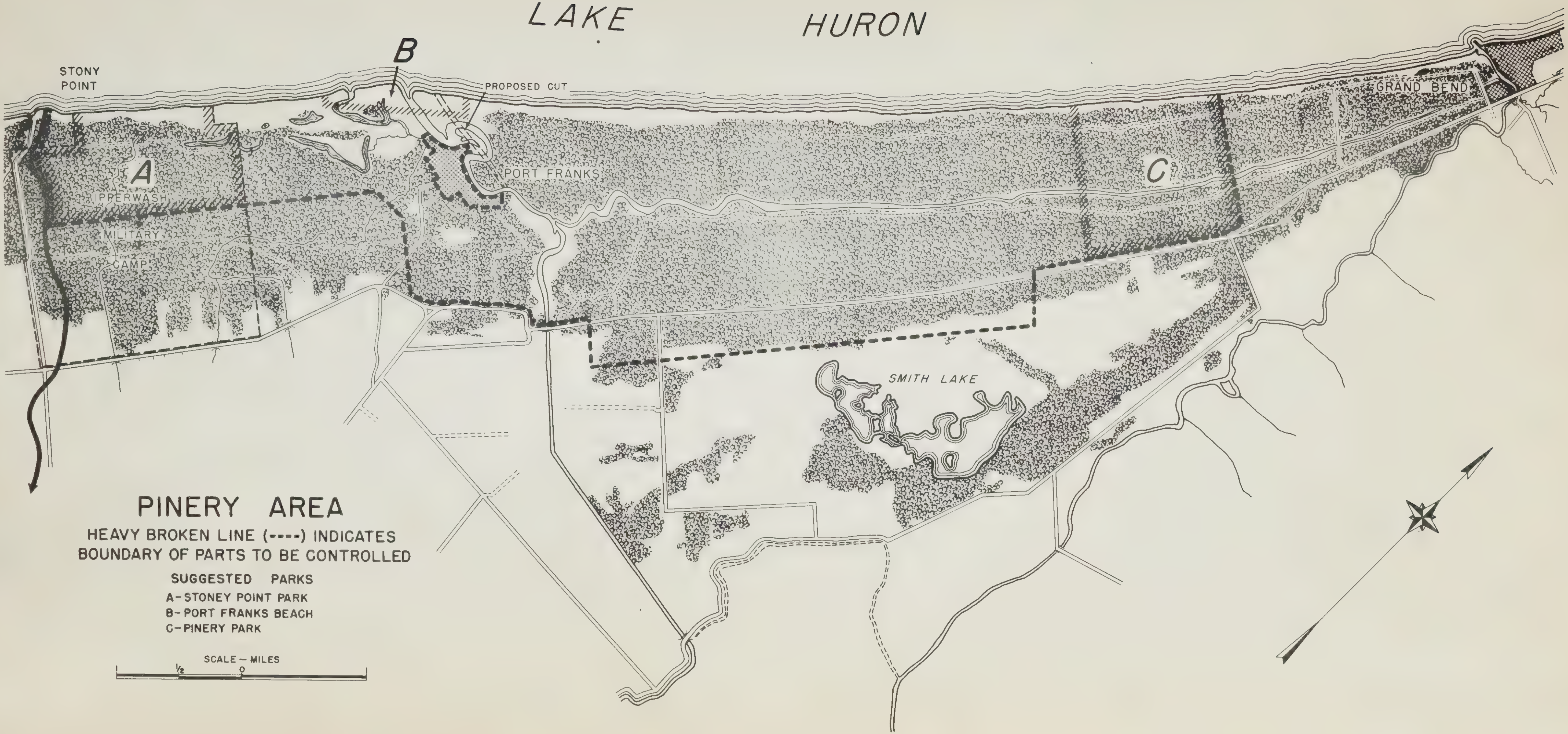
RECOMMENDED FACILITIES

The foregoing pages have indicated advantages to be gained by an overall plan of development of recreation facilities and by the actual acquisition of a few areas which would be public property for all time. It remains to make specific recommendations of the most suitable areas in the watershed.

The two accompanying maps of the Lake Huron beach area show what might be carried out in that part of the watershed. It would hardly be practical to recommend to the Conservation Authority that it acquire and administer the whole "Pinery" and beach area, although this might be in the best interests of the residents of the watershed. A more practical approach would be the acquisition of two or three small areas of suitable beach and adjoining land, and the passing of a zoning by-law by the Township of Bosanquet over a much larger area in such a manner that cottage owners, store proprietors and casual visitors all would benefit. A suitable area for such centres would be that indicated as the "Pinery" area on the accompanying Recreation map.

Section 406 of the Municipal Act gives the Municipality the necessary authority to carry this out. It would certainly be advantageous for the township to have technical advice and detailed plans concerning the methods of zoning the area, from those who have had wide experience zoning similar areas elsewhere. For this purpose, there are available in the Province of Ontario several professional community planning consultants. The Community Planning Branch of the Department of Planning and Development of the province will also be glad to give advice in such matters.

The area involved in such planning includes 8,970 acres, none of which is agricultural land. It is important to preserve the "Pinery" near the lakeshore quite apart


LAKE HURON
STONY POINT
B
PROPOSED CUT
GRAND BEND
A
IPPERWASH
MILITARY CAMP
PORT FRANKS
C
SMITH LAKE
PINERY AREA
HEAVY BROKEN LINE (----) INDICATES
BOUNDARY OF PARTS TO BE CONTROLLED
SUGGESTED PARKS
A-STONEY POINT PARK
B-PORT FRANKS BEACH
C-PINERY PARK
SCALE – MILES
1/2
0

from its value for recreation, since it serves the purpose of anchoring the sand dunes. The areas best suited to cottage development, public beaches, distributing centres for tourists' and cottagers' supplies and for any other purpose could be defined and the zoning enforced. Rondeau Park and Pelee Point National Park on Lake Erie are two areas which have already been zoned in this manner. Many municipalities in Ontario and the United States have been similarly zoned, including many cities and some townships. The whole area might be designated the Ausable Forest.

1. Large Public Parks:-

These areas are lettered "A", "B" and "C" on the accompanying map:

(a) Stoney Point Park - "A":-

This piece of land includes 775 acres and most of it is already Dominion Government property, being the westerly part of the former Ipperwash Military Camp. It includes oak forest, sand dunes and beach in addition to a fine lagoon of the old Ausable River mouth, in which water-lilies and marsh plants of interest to naturalists are common. An old road now disused and impassable leads to the proposed park from No. 21 Highway. This area would be of particular interest to campers. Proper facilities for trash disposal are already an urgent need in this part of the area already in use (fronting Lake Huron). Many campers who are settled only a few feet from the beach stay for periods up to two weeks with no sanitary conveniences or method of trash disposal. Thus the beach and dunes rapidly become littered with debris.

(b) Port Franks Beach - "B":-

This area includes 160 acres only. It is intended as a public beach for the Port Franks area, but includes both sides of the mouths of the Ausable River and Mud Creek. The area includes little more than sand beach. It is assumed there would be intensive development of cottage sites in the

ıe mouth of Mud Creek,
ar Port Franks. This
ea is beginning to be
ilt up. The beach is
ways crowded on fine
ekends.

ind the sand dunes,
th of Port Franks lie
ır lagoons and un-
iled woods.

lake lies in the
ıer Ipperwash Military
ıp, recommended for
uisition for the public.

immediate neighbourhood of this beach. The exact location of the area could not be determined until the Conservation Authority has completed its plans for dredging, or flood control, at the river mouth.

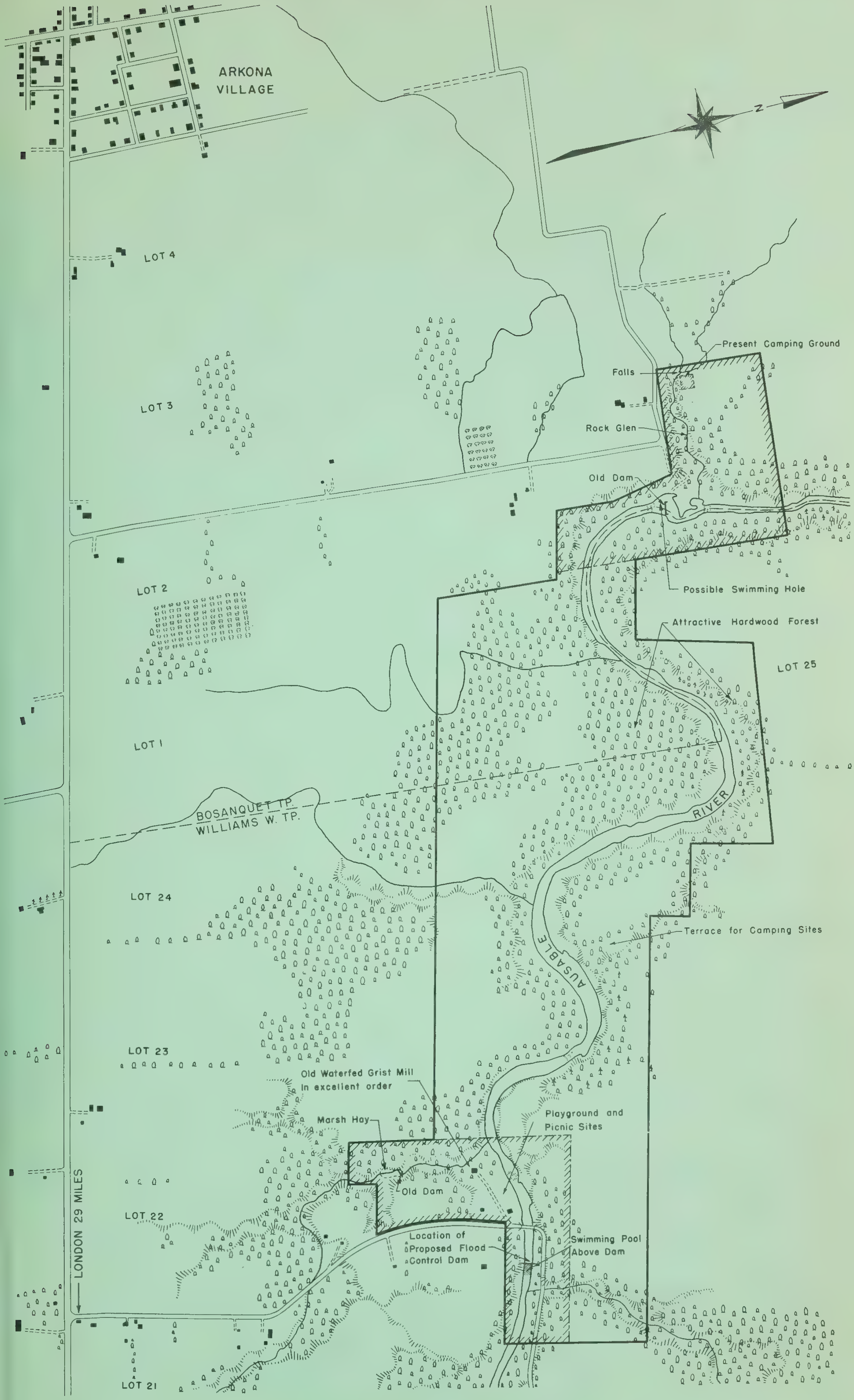
(c) Pinery Park - "C":-

This area includes 1,045 acres of the "Pinery". Within its boundaries lies a typical part of the present forest, including the most attractive section of the winding old Ausable River course and of the old "Pinery" road, long since disused. A sand road already connects the park area to No. 21 Highway.

A park of this type, besides being of interest and use to the general public, would attract many naturalists. The woods should be preserved with the absolute minimum of alteration.

(d) Ausable Gorge Park:-

The great beauty of the Ausable Gorge and the interest excited by its great fossil beds attract many thousands of people every year. It is, therefore, recommended that an area of 370 acres, as outlined on the accompanying map, should be acquired by the Conservation Authority and administered for the public. It will be seen, by reference to the map, that almost the entire area is either bottom land or river bed on the wooded slopes of the gorge. The only agricultural land would be a few acres south of the river and most of this is in poor pasture. Two areas are recommended for more intensive development. The westerly one includes the famous Arkona Rock Glen and Falls. These should certainly not be allowed to be closed permanently to the public, which might happen while they remain in private hands. An old Scout Camp ground is still used at the head of the falls. This could be enlarged and a car parking area prepared close to it. It is assumed there would be two entrances to this park, one at the top of the Arkona Glen and one at the second area marked



PROPOSED

AUSABLE GORGE PARK

LEGEND

RECOMMENDED PARK BOUNDARY

AREAS FOR INTENSIVE DEVELOPMENT

WOODLAND

SCALE: FEET

0 200 400 800 1200

The head of the falls at the Rock Glen near Arkona.

The Rock Glen falls from below.

The Rock Glen below the falls. The Glen and falls both lie within the proposed Ausable Gorge Park.

for intensive development close to the bridge at the other end of the park. The old water-fed grist mill, which has not long been abandoned, could be kept weather-tight and would acquire more and more importance as time passes. The old dam on the tributary, which fed the grist mill could be repaired with a wide flood spillway. The park includes a few acres of the catchment basin of the proposed Arkona flood control dam and the dam itself. A swimming pool would be available above and close to the dam. There is an excellent area suitable for a playground near the bridge over the Ausable. A terrace suitable for camping sites is available north of the river. There are numerous springs of cool, pure water on the south bank of the river. An attractive hardwood forest covers all but the steepest slopes south of the river.

This is a park which is not recommended as a new idea. It has been a fascinating playground and site for natural history hikes for many years. It has, however, been up to the present used only by courtesy of many property owners. To add interest to this park, a nature trail might be laid out along the gorge, a project which the local Scout Group might carry out. Some poison ivy control might be necessary along the trails. This park would gradually pay for itself through profits on concessions for refreshment sales, the rights to which would be leased annually. There are several eroded slopes on the north side of the Ausable River in the park. These could be used for a demonstration of reforestation methods and results.

2. Smaller Parks and Picnic Sites:-

These are small areas of from one to five acres, which might be acquired at each of the attractive picnic sites which are listed below. Speed is essential in acquiring such sites before the remaining trees on them are cut down. Several of these sites are located at old swimming holes. One of them, Lucan Park, could be larger than the others since it is located

A side-road in Stephen Township marred by thoughtless dumping of refuse.

This attractive picnic site n the upper Ausable is ecommended for acquisition.

ıother part of the same :nic site as above. The :ation is part of Lot 6, 'ncessions X and XI, :Gillivray Township.

at a strategic point on the main road from London to the Bruce Peninsula. The list is as follows:-

(a) At the Village of Nairn, alongside the Ausable River north of the bridge, Williams East Township, Middlesex County - 2 acres.

(b) Part of Lot 6, Concessions IX and X, McGillivray Township, Middlesex County - 4 acres.

(c) Part of Lots 23 and 24, Concession III, Biddulph Township, Middlesex County.

(d) Part of Lot 19, Concession XII, Hibbert Township (one mile west of Cromarty, Huron County).

(e) Part of Lot 19, Concession IV, Hay Township, Huron County.

(f) Part of Lot 5, Concession V, McGillivray Township, Middlesex County, one half mile north of Parkhill.

3. Dumping of Refuse:-

Steps should be taken gradually to improve the public attitude concerning the dumping of garbage and refuse on side-roads. There have been numerous complaints concerning the practice of dumping the garbage and refuse of Grand Bend close to the Blue Water Highway in Bosanquet Township. This is offensive to those who live close by, it creates a fire hazard and the area is infested with rats. No by-law is adequate to cope with this condition. Public education is the only solution.

AUSABLE WATERSHED
LAND USE SURVEY
RECOMMENDED LAND USE
UNRESTRICTED USE
LD
DRAINABLE
CONSERVATION FARMING
LR
RESTRICTED USE
PL
PASTURED AND CULTIVATED
P
PASTURED
Long term pasture
WOODED
SPECIAL USE
Truck crops, market gardens and orchards
PERMANENT VEGETATION
Woodland or pasture
SCALE - MILES
ONTARIO DEPARTMENT OF PLANNING AND DEVELOPMENT
CONSERVATION BRANCH
GRAND BEND
DASHWOOD
KHIVA
CREDITON
CENTRALIA
EXETER
ELIMVILLE
FARQUHAR
WINCHELSEA
USBORNE TWP.
CLANDEBOYE
LUCAN
THEDFORD
PARKHILL
CRAIG
NAIRN
FALKIRK
DENFIELD
ARKONA
LAMBTON CO.
MIDDLESEX CO.

AUSABLE WATERSHED
LAND USE SURVEY
PRESENT LAND USE
CULTIVATED
PASTURE
WOODLOTS
NON-AGRICULTURAL
ONTARIO DEPARTMENT OF PLANNING AND DEVELOPMENT
CONSERVATION BRANCH
LAKE HURON
PORT FRANKS
GRAND BEND
ZURICH
HENSALL
STAFFA
CROMARTY
EXETER
DASHWOOD
CREDITON
CENTRALIA
SHIPKA
KHIVA
CLANDEBOYE
LUCAN
THEDFORD
PARKHILL
AILSA CRAIG
DENFIELD
NAIRN
ARKONA


AUSABLE WATERSHED
LAND USE SURVEY
SOILS
LAND FORMS
BEACH B
LAKE SAND PLAIN S
KAME MORAINE K
LAKE CLAY PLAIN C
CLAY VENEER TILL V
SILT VENEER TILL L
LAKE SILT PLAIN C'
PEAT P
MUCK m
SILT S'
TILL PLAIN T
CLAY MORAINE TM
BOTTOM LAND BL
SPILLWAY W
SAND BLOW HOLES u
BOULDER BEACH
LAND CONDITIONS
DRAINAGE
Imperfectly drained d
Poorly drained p
SLOPES
2-5 percent A
5-15 percent B
over 15 percent E
HUMMOCKY SLOPES
5-15 percent N
over 15 percent R
EROSION
Into topsoil 1
Into subsoil 3
Into parent material 5
SCALE - MILES
ONTARIO DEPARTMENT OF PLANNING AND DEVELOPMENT
CONSERVATION BRANCH
LAKE HURON
GRAND BEND
ZURICH
DASHWOOD
CREDITON
EXETER
CENTRALIA
SHIPKA
KHIVA
PARKHILL
THEDFORD
ARKONA
CLANDEBOYE
LUCAN
DENFIELD
FALKIRK
NAIRN
AILSA CRAIG
FARQUHAR
WINCHELSEA
CROMARTY
STAFFA
KENSALL
FORT FRANKS
STANLEY TWP
HAY TWP
STEPHEN TWP
USBORNE TWP
BIDDULPH TWP
LONDON TWP
ADELAIDE TWP
CARADOC TWP
BOSANQUET TWP
WARWICK TWP
LAMBTON CO.
MIDDLESEX CO.
HURON CO.
PERTH CO.

SOURCE AREAS
REFORESTATION LAND
AND
EXISTING WOODLAND
LEGEND
EXISTING WOODLAND
WILLOW SCRUB
LAMBTON COUNTY FOREST
FOREST COVER TYPES
TYPE NO. TYPE NAME
3 RED PINE
4 ASPEN
6 PAPER BIRCH
9 WHITE PINE
10 WHITE PINE-HEMLOCK
11 HEMLOCK
12 SUGAR MAPLE-BEECH-YELLOW BIRCH
13 SUGAR MAPLE-BASSWOOD
14 SUGAR MAPLE
14A BLACK CHERRY
24 WHITE CEDAR
25 TAMARACK
26 BLACK ASH-WHITE ELM-RED MAPLE
45 BUR OAK
46 RED CEDAR
49 WHITE OAK-BLACK OAK-RED OAK
51 RED OAK-BASSWOOD-WHITE ASH
57 BEECH-SUGAR MAPLE
58 BEECH
59 ASH-HICKORY
60 SILVER MAPLE-WHITE ELM
60A WHITE ELM
61 COTTONWOOD
88 WILLOW
P PLANTATION
SOURCE AREAS
1. HAY SWAMP
2. HARPLEY
3. PINERY
4. SMITH LAKE
5. RIVER BEND
6. ARKONA
7. McINNIS
8. PARKHILL
9. BORNISH
10. KEYSER
11. AILSA CRAIG
12. CLANDEBOYE
13. STAFFA
SCALE : MILES
1 ¾ ½ ¼ 0 1 2 3
ONTARIO DEPARTMENT OF PLANNING AND DEVELOPMENT
CONSERVATION BRANCH
LAKE HURON
GRAND BEND
ZURICH
HENSALL
DASHWOOD
EXETER
KIRKTON
CENTRALIA
Smith Lake
STANLEY TP
HAY TP
STEPHEN TP
MC GILLIVRAY TP
USBORNE TP
BIDDULPH TP
BLANSHARD TP
TUCKERSMITH TP
HIBBERT TP
FULLARTON TP
HURON CO.
PERTH CO.
MIDDLESEX CO.
LAMBTON CO.
AUSABLE RIVER
LITTLE AUSABLE
MUD CREEK
RIVER


5
6
7
8
9
10
11
12
MORAY CREEK
MUD
JERICHO CREEK
CREEK
DECKER CREEK
THEDFORD
PARKHILL
AILSA CRAIG
LUCAN
C.N.R.
LITTLE AUSABLE
RIVER
NAIRN CREEK
AUSABLE RIVER
ADELAIDE CREEK
MC GILLIVRAY TP.
WILLIAMS W. TP.
WILLIAMS E. TP.
BOSANQUET TP.
WARWICK TP.
ARKONA
ADELAIDE TP.
LOBO TP.
LONDON TP.
CARADOC TP.
LAMBTON CO.
MIDDLESEX CO.